# Engineering Record

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## Societies and Education

AN UNUSUAL amount of space is given in this issue to articles and comment on engineering education, engineering society activities and the field of the engineer. The space devoted to these subjects is a fairly good indication of the widespread interest which these subjects hold for the members of the profession at the present time. Professor Mann's studies and the facts brought out with reference to the decline in the registration of civil-engineering students have directed new attention to engineering education, while the proposal to move the headquarters of the American Society of Civil Engineers and the activity of local societies throughout the country have opened up new vistas of society usefulness. Both are healthy signs, for the engineer's education and his co-operative activities are the chief factors determining his status. Careful reading is therefore urged of the discussion between Professors Mead and Swain, of the article by Mr. George and the letter from Professor Newell. Aside from the intrinsic merit of the subjects, each of these articles contains new and interesting points of view.

## Surfaced Concrete Roads

WHEN the California Highway Commission a couple of years ago decided to devote the bulk of its $18,000,000 bond issue to a type of construction consisting of a 4-in. concrete base with a thin bituminous wearing surface the prediction was freely made that the roads would be a failure. The commission faced the problem of developing a huge mileage of state highways with insufficient funds. It had the alternatives of choosing between a small mileage of high-priced construction, serving only the main centers of population, or a relatively large mileage built at a lower cost and covering the entire State. It selected the latter, and with this decision as to policy went the "thin bituminous top" construction. Highway engineers in other states have shown a keen interest in California's work and have, of course, been eager to learn how the type adopted has been standing up under service. This question is answered by Walter C. Howe, division engineer, in a report submitted Feb. 26 to Austin B. Fletcher, state highway engineer, and printed, in part, on page 603. Basing his conclusions on an experience with 400,000 sq. yd. of construction, some of it two years old, Mr. Howe states that for average highway traffic the bituminous carpet of heavy asphaltic oil and broken stone screenings has begun to demonstrate that it is an economical and very successful type of surfacing. It must, however, be laid by an experienced crew and under expert supervision. It is not a panacea, for it is unsuitable for extremely heavy traffic. When properly laid, however, and under moderate traffic the life of the surfacing, Mr. Howe believes, will, with moderate repairs, exceed the period of three or four years originally predicted for it. In appraising the value of the thin bituminous surfacing on a 4-in. concrete base, for general use, engineers in other states should give due consideration to the fact that the California roads are not subjected to the rigors of wide temperature changes so common in most sections of the United States.

## Self-Examination

PROFESSOR NEWELL in his letter to the editor on page 620 of this issue, commenting upon a recent editorial in this journal, expresses clearly, but in greater detail, the thought in the minds of the editors in pointing out the need for constantly keeping before the officers and membership of a society the ideals toward which it is supposed to be striving. The thought around which Professor Newell's comment revolves is that constant self-examination is necessary in order that a society may constantly increase the value of its service to its members. When an individual, a society, a corporation does one or two things very well the natural temptation is to let well enough alone and to consider that the full obligation has been discharged. If the temptation be yielded to, the individual or the body is in a dangerous position. Others will rest not, but by constant self-examination will endeavor to improve, with the result that the complacent ones are passed in the race or at least have their relative prestige lowered. The adage, "Constant vigilance is the price of safety," can well be paraphrased for the individual, for the society and for the corporation to read, "Constant self-examination is the price of success."

## Society Service

IN THE April "Journal" of the Boston Society of Civil Engineers there appeared an article by Edward M. Blake (see last week's issue) in which he lays special emphasis on the thought that membership in a society should carry with it not only the privilege of receiving something, but also the duty of giving service to the society and to the profession. Mr. Blake says: "We cannot draw from a bank unless we have put in something to draw upon, and the more we put in the more we can draw out. . . . With this conception [a true spirit of service] firmly established in his mind, the engineer who joins a society will consider of first importance the question of what he can add to the society and not of what he can get out of the society in return for his annual dues. Service for the society will follow, and soon there will be no need of arguing the other side—that of the benefits to be received from membership in the society." Mr. Blake's words may well be taken as a supplement to the editorial "Service of Engineering Societies," which appeared in the Engineering Record of April 1 and which has caused considerable comment. Societies well may ask themselves whether they are affording full opportunity for their membership to be of service to the organization and to the profession. The easy answer is that everyone is invited to prepare papers, but that answer merely dodges the issue. Many will serve when drafted for service who would not volunteer to help.

## For President, A. S. T. M.

FOR the first time in the history of the American Society for Testing Materials the name of a representative of the producing interests has been offered by the nominating committee for the presidency of the society. A. A. Stevenson, vice-president of the Standard Steel Works Company, at present vice-president of the society and for many years one of the most active and valuable members of committee A-1, on standard specifications for steel, is the nominee. The nomination is a tribute to Mr. Stevenson's sterling character and to the high quality and purpose of his work in the society. At the same time the fact that it has not feared to propose for the highest position in the organization a representative of the producing interests, is a tribute to the broadmindedness of the society as represented by its nominating committee. It is a fitting compliment, too, to the spirit which the manufacturers have displayed in their work in the organization. In the early days of the organization doubts were expressed as to the possibility of a permanent and thoroughly trustworthy body in the deliberations of which the manufacturers were given so large a voice. For that reason the management was unusually circumspect at the start, careful lest some misguided producer might endeavor to take improper advantage of his membership privilege. But those fears have long since been dispelled, and, if anything, the raising of a producer to the presidency has been too long delayed. Now it is fully recognized that the society could not have become so useful to the engineering profession had the manufacturers been eliminated from membership and their tremendous contributions to the development of engineering science rejected. The organization owes its success no less to the ability and sterling work of the producing interests than to the contributions and ability of the non-producing members. Mr. Stevenson's nomination is fitting recognition of this fact.

### New York's Boring Records

NO ARGUMENT is needed to convince engineers of the value of sub-surface information obtained by means of drills, test pits and larger-sized excavations, but until the Municipal Engineers of the City of New York conceived the plan for a single permanent collection of local rock cores and other samples no one apparently had visualized the immense importance of a round-up of the city's underground records. For many months past a committee of the Municipal Engineers has been assembling data secured from all available sources, and at a meeting last month James F. Sanborn made the important announcement that space for the collection had been secured in a room set apart for the purpose in the Municipal Building, and that the Board of Estimate and Apportionment had voted $5,000 for the work. This is good news for New York contractors as well as engineers. It means that information regarding underground conditions, formerly unavailable, or available only after tedious investigation of scattered and fragmentary records, will now be centralized and easy of interpretation. But the committee has not stopped at the mere collection and classification of rock samples. It is proposed to formulate a set of rules and suggestions with reference to proper methods to employ on underground surveys. Thus the whole routine will be standardized and the results increased in value manyfold. Engineering organizations in other cities might well follow the example of New York's Municipal Engineers. There is opportunity for constructive work and it is precisely along this line that local engineering societies can demonstrate their value to the community at large.

### Alaska's Government Railroad

WHOEVER has pictured in his mind the government railroad in Alaska winding its way through tortuous canyons, leaping across chasms on bridges requiring ingenuity to design and daring to erect, plunging through tunnels and doubling around mountains to gain elevation, will be disappointed when he reads the article by Mr. Riggs of the Alaskan Engineering Commission, on page 600 of this issue. There will be none of these engineering triumphs, because none of them will be necessary. Except for the difference in climate and vegetation, and the difficulties of getting men, materials and supplies to the work, the line could as well be over the Alleghany Mountains, and even there at one of the easiest points. Broad Pass, for example, is 5 miles wide and only 2400 ft. above sea level. As to what the problems have been in Alaska, what has been done with the funds available, whether or not the road is needed at all, the Engineering Record leaves that to the readers of Mr. Riggs' article. One point not brought out in the article, but mentioned by Mr. Riggs elsewhere, is the character of construction. A common criticism of governmental works has been their elaborateness, in disregard of the traffic and other necessities. This criticism hardly applies to the Alaska railroad. Following the example of private pioneer railroad builders, the government is suiting the construction to the traffic in sight, and building a railroad serviceable but not fancy. The Alaskan Engineering Commission and the Department of the Interior deserve commendation for this policy. Other government agencies, including the Congress which appropriates money for the improvement of impossible muddy creeks, should take notice.

## New Engineering Field in Chambers of Commerce

MR. JAMES Z. GEORGE, industrial engineer for the New Orleans Chamber of Commerce, points out a new and very attractive field for engineers in his article on page 604 of this issue. Once attention is called to it one is surprised that the opportunities were not fully appreciated before. Community building is very largely an economic and engineering problem. Other matters, such as the commercial and social life of the city, need attention, but all rise from an engineering and economic foundation. Chamber-of-Commerce activities in municipal-engineering matters is not an innovation, though the New Orleans method of handling this activity, through a qualified salaried engineer, is new. The main departure at New Orleans, and the one that is sure to be copied elsewhere, is the function of the industrial engineer in the promotion and development of the industrial life of the community. Most of us know of the spread-eagle and red-fire methods of attracting industries, and know how little thought is given to the economic questions which should be considered in locating a plant. Failures—many of them—were to be expected. But where there has been one failure there are probably now, merely eking out an existence in "stimulated" locations, half a dozen factories which would be paying plants if fundamental economic considerations had not been neglected.

But aside from the opportunities and advantages on which Mr. George has enlarged, the Engineering Record sees in the entrance of the engineer into this field another decided benefit. It should give an opportunity, through publicity, to throw engineering work into its proper relation into the community's life. The commercial, and latterly the social welfare, factors have dominated the work and the publicity of chambers of commerce to the almost entire exclusion of engineering matters. When engineering problems do come to the fore, they are treated with a bias born of unconscious, but nevertheless deplorable, ignorance.

Engineers and engineering societies have given especial attention to publicity in recent years. They should recognize the position described by Mr. George as an opportunity for more effective educational work, as an ally for giving engineers and engineering their proper place in community affairs.

Engineers qualified by training—long and broad training in industrial matters—and with sales and publicity instincts, may well give consideration to the new field. The appointment of Mr. Paul Gendell, formerly manager of the Engineers' Society of Pennsylvania, to the secretaryship of the DuBois, Pa., Chamber of Commerce indicates that there are already those who see the opportunity.

## Present-Day College Education

"I NEVER feel that I have hit hard unless there is a rebound," said a famous orator, and that thought comes to mind in reading the discussion between Professors Mead and Swain on college education, which appears on page 607 of this issue. Professor Swain hit hard in his original communication. He spoke frankly on matters that are of the gravest concern to educators—the characteristics of the men they turn out. It was but natural that his views should meet with opposition—opposition based on misunderstanding of his position or on radically different experience.

As often, in controversial matters, some of the differences are more apparent than real. For example, on the matter of common sense, Professors Mead and Swain are not far apart, though they differ as to the cause of whatever lack of common sense they concede.

On some points, though, there is wide difference, and though Professor Swain contends that there is no difference in the schools, one cannot but feel that there must be disparity in some of the factors between East and Middle West. On any other theory it is hard to account for the divergence. Is it in the spirit of the schools? Is it in the home training, preparatory schooling or attitude of the men? Only a thorough acquaintance with the two sections of the country in question, and with their young men and educational institutions could justify one in speaking with finality.

On one point in controversy—whether or not college men, on the average, are accurate and thorough—the divergence should be less than it is. The experience of the Engineering Record favors Professor Swain's rather than Professor Mead's position. Recent college graduates who are accurate and thorough are not easy to find. One cannot expect from them the finish of practitioners in the handling of technical problems, as Professor Mead well contends, but employers have a right to expect in the young men habits of accuracy and thoroughness and the power of sustained, logical thinking.

On one point the agreement of the two professors is particularly gratifying—that "more moral training and more discipline" are needed. Such training and discipline are crying needs throughout our entire educational system. In fact, military drill for pupils in the grades and in the high school has many advocates because of the disciplinary effect, aside from all considerations of a strictly military character. One consulting engineer, employing normally from 30 to 40 men, has found his work to suffer so much from the employment of undisciplined college graduates that he makes a practice of securing West Point and Annapolis men whenever possible, and as a second choice takes technical graduates who have worked their own way through college. His experience is that these men have learned to obey and submit more readily to the routine of the organization.

Professor Swain well commends the work of Dean Herman Schneider at the University of Cincinnati. Dean Schneider, by the plan of alternate periods in school and in the shop, secures a constant appraisal of the student's scholastic attainments, and puts his knowledge to constant test in practical work. Most of the shortcomings of which Professor Swain complains cannot continue under such test. The student must mend his ways or force his own elimination from the course. The discipline is a severe one, but perforce most beneficial, for the qualities most worth while are developed through arduous work.

Controversies such as that here discussed have a very decided value. They throw into relief important questions. These must be thrashed out if the sanest and best development is to ensue.

## National Freight-Handling Companies

DESPITE all the attention given it, the handling of freight at terminals seems to show very little improvement. Here and there mechanical devices, particularly at ports, have effected economies, but when the whole problem, including the haulage from shipper to terminal and from terminal to consignee, is considered the conclusion is forced on one that progress has been slow. On page 606 of this issue the matter is discussed again. Mr. Marshall has hit at the root of the difficulty when he proposes large, well-organized trucking companies. Efficiency in freight handling, as far as city haulage is concerned, is low because each small shipper and consignee works independently and according to his own whim. No effort is made to handle the business as a whole, scheduling and classifying it in accordance with any well-thought-out plan. In fact, with a multitude of individuals, each seeking to serve his own interests, co-ordination is impossible. The remedy, obviously is to substitute large companies which will subordinate the whims of individuals to a system that will make for greater efficiency and, in the long run, be a benefit to all parties. This scheduling of freight handling, and haulage by night as well as by day, in order to iron out the peaks and thus secure maximum use of haulage equipment and freight terminals, has previously been advocated in this journal.

When, however, Mr. Marshall proposes the formation of national companies to do this work he breaks forth into a new field. The minute this plan is proposed question arises as to details. These Mr. Marshall has not given, and consequently judgment on the plan will depend entirely upon the supposition as to details made by each individual. Shall this company handle the trucking at either end only, or shall it, like the express companies, own its own cars and assume full responsibility for the goods in transit. If it were to take the latter course, the procedure would be a radical change from present practice. The first plan, of merely handling the haulage, would be but an extension of the local company organization mentioned in the previous paragraph.

Whatever the details, however, careful study of the possibilities of this scheme and of other serious plans that may have the same end in view are worthy of close analysis and study. Terminal charges are so excessively high that any measures that will reduce them will be a boon to the transportation interests and will materially cut down the transportation overhead which all commodities must now bear. Progress toward a solution is exceedingly slow, and it would not be surprising if effective reduction of terminal rates would wait upon the discovery of some radically new method of treatment. Applications of methods now well known have not been received with much enthusiasm by the railroads, while the large trucking organization, local or national, capable undoubtedly of reducing costs, apparently does not hold out promise of sufficient economies for individual shippers to encourage capital to embark in the enterprise. A trial with it, however, might quickly develop the weak spots and advantages, and lead the way to a thoroughly satisfactory solution of the problem.

## Another Enormous Railroad Improvement for New York City

FOR MANY YEARS negotiations have been going on to bring about radical changes in the West Side freight line of the New York Central Railroad in New York City. The problem was a big one, and very complex. The main basis for the improvement was the demand for the renewal of the tracks from the grades of Tenth and Eleventh Avenues. At the same time the users of Riverside Park and other parks sought to have them relieved from the smoke and bad-odor nuisances and the shutting off of the public from the Hudson River front. These, with improvements wanted at other points, involved practically the entire 12-mile line. Among the agitators were not a few who, indifferent alike to the rights of corporations and to the invaluable service rendered by this particular corporation in bringing food to the city, wished to throw the railroad bodily into the river. Others, more reasonable but nevertheless obstructionists, opposed what they thought would give the New York Central a permanent monopoly on the bulk of the city's business. All manner of minor objections were raised to practically every change all along the line. Naturally the New York Central, having rather definitely established its right to be there, had no intention of spending millions without obtaining any offsetting advantages. Hence the protracted negotiations, which have now resulted in a tentative understanding between city and railroad. The main features of that understanding are set forth on page 612.

As a reading of the article will indicate, the expenditure of $50,000,000 to $100,000,000 on the project ranks it with the recent passenger terminal improvements of the Pennsylvania and the New York Central in New York City. Moreover, it is without doubt the most expensive freight terminal improvement ever projected.

Since the preparation of that article the public hearings mentioned have begun. Judging from the first of these, last Monday, there is almost unanimous approval of the project as a whole. The main objections are on two points. Certain uptown associations look askance at the unwillingness of the railroad to build the bluff above Manhattan valley out over the steel roof it offers to construct over its main tracks, and believe that even then the uncovered yard beyond may become a nuisance and spoil the park. Hence they want at least a reservation in the contract that the yard may be covered later if the city desires it. Then certain idealists who cling to the idea of a marginal railway and belt of warehouses around Manhattan fear that the proposed change south of Thirtieth Street, where the New York Central seeks a private right-of-way, will be a barrier to the development of this general warehouse belt.

This journal believes that both of these objections are unwarranted. As to the marginal railway and warehouse belt, the Engineering Record is heartily in favor of this form of terminal development where feasible. Looking over the New York Central plans and noting what facilities this one railroad deems necessary for its individual purposes, one is inclined to doubt whether a line adequate for all of the New Jersey roads is feasible in lower Manhattan. Assuming that it is, however, the present project leaves ample room for the later development, and even though the warehouse belt may have to be narrow in places, that local restriction does not seem serious to a line around lower Manhattan.

As to the covering of Manhattanville yard, the electric operation and the fact that the yard will be far below the level of the park make it unlikely that it will ever be a serious nuisance. Those who point to the lower level of the proposed Thirtieth Street yard as proving the feasibility of operating a covered yard overlook the fact that the latter is a loading and delivery yard, where there will be comparatively little switching.

In a nutshell, the railroad has conceded about all it will to the city, and Controller Prendergast made it plain at the hearing Monday that every objection raised there had been thrashed out in conference. The outstanding feature of the tremendous project is that the railroad offers to spend a large sum of money on a piece of work that will improve civic conditions vastly. It is, therefore, unwise to indulge in further argument over details, or to hold down this company that is ready to act, because it is thought that other railroads might at some later date desire to participate in the work. The proposed improvement would be a boon to the city and the Engineering Record hopes it will go through substantially as planned.

# The Government Railroad in Alaska—What Two Years and Limited Funds Have Accomplished

## In Expenditure of $2,467,914 Alaska Northern Railroad Has Been in Part Paid for and Rehabilitated, Extension to Matanuska River Practically Completed and Entire Line Located

By THOMAS RIGGS, JR.
Member Alaskan Engineering Commission

LOOK FIRST at a map of Alaska. The panhandle is a narrow fringe along the sea and does not need a railroad. It is served entirely and well by water. A narrow-gage railway from Skagway to Whitehorse breaks through the mountains and forms a part of the White Pass and Yukon Route to the waters of the Yukon and its tributaries. As far as this article is concerned, we can eliminate the panhandle. The great balance of Alaska, approximately one-sixth of the United States, is without adequate means of transportation.

From Cordova on the east side of Prince William Sound the Copper River & Northwestern Railway, a standard-gage road, runs northward along the Copper River to Chitina at Mile 131 and then bends eastward for 65 miles and halts against a mountain, but directly under the ore bins of the Bonanza Mill. The marvelous Kennecott copper mines were the real reasons for construction, although the railroad is now performing the functions of a common carrier in the development of a wonderful region of mineral resources.

LIGNITE EXPOSURES APPEAR IN SANDSTONE CLIFFS IN NENANA COAL FIELDS

On the west side of Prince William Sound, a standard-gage road, starting life under the name of the Alaska Central Railroad and now called the Alaska Northern Railroad, having its terminal at Seward, extends northward a distance of 71 miles. In the interior of Alaska a narrow-gage railroad 46 miles long serves the Fairbanks mining district. On the Seward Peninsula two little roads slumber peacefully on the Arctic tundra. A few other short stretches of construction in various parts of the territory serve strictly local demands or are out of commission entirely.

So much for railroad transportation in Alaska until the act approved March 12, 1914, put new life into moribund schemes for the mineral and agricultural development of a country so rich in possibilities as almost to cause skepticism.

In 1912, under authority from Congress, President Taft appointed a commission, consisting of Maj. Jay J. Morrow of the Corps of Engineers, U. S. A.; Alfred H. Brooks, of the U. S. Geological Survey; Leonard M. Cox, Civil Engineer, U. S. N., and Colin M. Ingersoll, consulting engineer, of New York, to examine into railroad possibilities in Alaska and report on routes which would best serve the development of Alaskan resources. Their work was admirably accomplished and an exhaustive and valuable report submitted.

### ENGINEERING COMMISSION IS FORMED

In May, 1914, President Wilson, advised by Secretary Lane of the Interior Department, appointed William C. Edes, chief engineer, Northwestern Pacific Railroad; Lieut. Frederick Mears, superintendent, Panama Railroad, and Thomas Riggs, Jr., engineer, Alaskan Boundary Commission, a commission to make certain surveys, estimates and investigations on which routes could be definitely selected by the President and a railroad constructed, for which purpose Congress had authorized a sum not to exceed $35,000,000. The commission was in the field from the latter part of May until November and then returned to Washington and submitted a report. Briefly the results accomplished in miles were as shown in Table 1.

TABLE 1—MILEAGES SURVEYED IN 1914

| | |
|---|---|
| Definite railroad location | 122.86 |
| Preliminary surveys | 875.99 |
| Valuation surveys | 70.80 |
| Reconnaissance surveys (Kuskokwim) | 726.00 |
| | 1,795.65 |

In addition, members of the commission inspected the harbors of Cordova, Valdez, Portage Bay, Seward and Controller Bay; made a careful examination of the Copper River & Northwestern Railway, covered the route between Seward, the Matanuska coal fields and Fairbanks, and between Fairbanks and the Nenana coal fields via the Tanana River flats, visited the Bering River coal fields, covered the route between Fairbanks and Valdez and Chitina, and made a detail examination of the survey between Valdez and the Copper River over Marshall Pass.

For the preliminary work Congress had appropriated $1,000,000. Of this amount the commission expended $393,059.92, this covering surveying equipment, pack trains and launches, transportation, salaries of fourteen parties, maintenance of headquarters at Ship Creek, compensation of weather observers at Portage Bay and Ship Creek throughout the winter, caretakers of stock and equipment at Ship Creek and Fairbanks, reduction of field notes, preparation of maps, charts and profiles and the final report.

### $2,000,000 APPROPRIATED FOR CONSTRUCTION

For the fiscal year 1915 Congress appropriated a further sum of $2,000,000 to start actual construction along a route to be selected by the President, and in April the President, through Secretary Lane, announced his selection of route, a copy of which has already been published in the Engineering Record. [See the issue of April 17, 1915, page 482.] Briefly stated, the road is to go from Seward on Resurrection Bay to Fairbanks, a distance of 466 miles, with a 38-mile branch to the Matanuska coal fields and a 5-mile branch to Ship Creek (or Anchorage, as it is now called). As part of the contemplated system the President authorized the purchase of the Alaska Northern Railroad for the sum of $1,150,000, for which a preliminary installment of $500,000 was paid, the balance to be paid in one year.

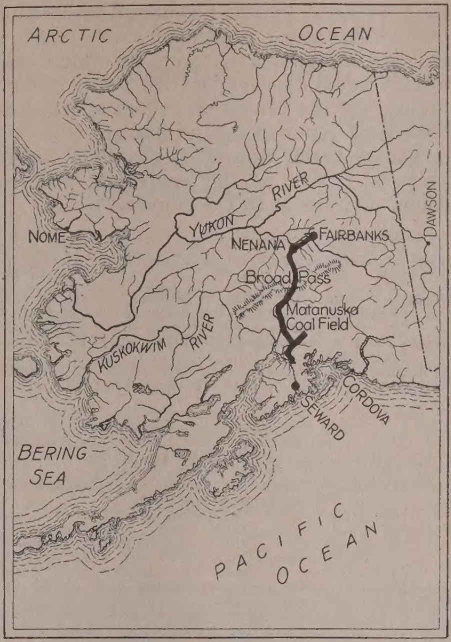
Through executive order the supervisory power was placed in the hands of the Alaskan Engineering Commission under the direction of the Secretary of the Interior. Mr. Edes was continued as chairman and chief engineer, with full veto power over all administrative matters. With $500,000 obligated to the Alaskan Northern Railroad Company there remained only a little more than $2,000,000 to be expended on construction. It was considered that the best results could be obtained by concentrating construction largely from one headquarters. The flat land near the mouth of Ship Creek was selected as the most available point for initial operations.

The chairman established himself at Seward, which has become the executive headquarters. To Lieutenant Mears was assigned the first brunt of construction, and to the writer the completion of location surveys from near Broad Pass to Fairbanks. For convenience the parcelling of authority was entitled Seward Division, Anchorage Division and Fairbanks Division.

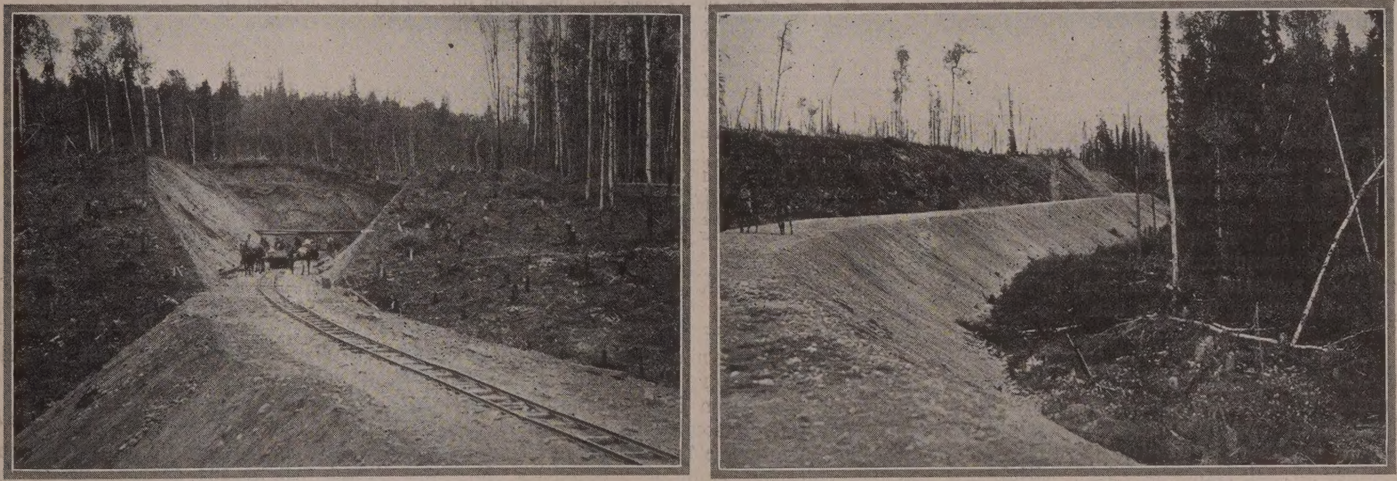
### HEADQUARTERS ESTABLISHED AT SEWARD

At Seward are established all the headquarters executive offices. The members of the commission report monthly to the chairman, who in turn reports to the Secretary of the Interior. All accounts from other divisions receive administrative action here before being forwarded to the auditor of the Interior Department at Washington for settlement.

On his arrival in May at Seward the chairman moved into the offices of the Alaska Northern Railroad, and pending adjustment of certain suits against the railroad took it over on lease. A small amount of reconstruction was attempted and the road put in shape for gas-car traffic as far as Mile 53. Beyond this the road was out of commission, owing to slides and washouts. In August the transfer of the road was effected and all property, including the dock, was turned over to the government. William C. Edes was designated as president, Frederick Mears as vice-president, and B. H. Barndollar secretary and treasurer. From the traffic receipts a small machine shop was erected and a number of minor repairs to the road were made.



POSITION OF LOCATED LINE



ALONG THE SHIP CREEK BRANCH—THE GRADING HERE AS ELSEWHERE IS BEING DONE MAINLY BY STATION MEN

For convenience the office of the purchasing agent is located in Seattle, C. E. Dole, formerly chief clerk of the Purchasing Division of the Isthmian Canal Commission at Washington, being in charge.

### FIRST CONSTRUCTION IS AT ANCHORAGE

The romance and honor of initiating the first government railroad construction in Alaska belongs to Mr. Mears.

Anchorage lies on Knik Arm of Cook Inlet. The range of spring tides is nearly 40 ft. Direct dockage is impossible under present conditions, and all steamers must lie in the roadstead discharging cargo to lighters, which come ashore on the tide. The first condition to be faced was that of landing material, men and supplies. There were available only one 60-ton cargo lighter, formerly the property of the Navy Department; a 50-ft. navy steamer; a flat-bottom stern-wheel boat, built by the commission the previous year, and a few privately owned gasoline launches. In a hurry additional lighters and power craft were accumulated, a high-tide wharf and warehouse was built, and a spur track laid through the mud to the higher ground along Ship Creek. Gradually a dismal, tent-dotted flat took on the appearance of a construction headquarters, pile drivers chugged industriously at landing wharves along the creek, a track stretched its way through material yards, and stiffleg derricks and locomotive cranes handled the fast-increasing supply of construction material.

In June grading was actively prosecuted. In almost every operation the small-contract system was employed. Clearing, grubbing and grading were let to stationmen—associations of laborers who take on a contract at an agreed-upon unit cost. Clearing and grubbing are paid for by the acre, and grading goes by the cubic yard. By this method very satisfactory results were obtained, and in all probability the method will be continued throughout the period of construction. Bridge work is done under force account, as is also tracklaying.

The first 150 miles of the accepted line lie entirely within the Chugach Forest Reserve, and authority was obtained from Congress to take material from the forest free of charge. The timber used from the forest is largely spruce or hemlock, and while inferior to the timber of Puget Sound, still answers all the immediate requirements for ties, piling and trestle posts. The larger bridge timbers are all brought from Washington or Oregon, as spruce of sufficient size and quality is not readily obtainable in Alaska, and owing to the local climatic and industrial conditions, cannot compete to advantage with the imported article.

Three locating parties operated in the Anchorage Division and a temporary telegraph and telephone line was pushed through to Kern Creek to connect with the line of the Alaska Northern.

Up to Feb. 29, 1916, in the Anchorage Division part of the results accomplished are given in Table 2:

TABLE 2—CONSTRUCTION DONE IN ANCHORAGE DIVISION UP TO END OF FEBRUARY

| | | |
|---|---|---|
| 1. | Clearing and right-of-way | 797.68 acres |
| 2. | Grubbing | 145.28 acres |
| 3. | Excavation | 941,819 cu. yd. |
| 4. | Track, 56-lb. rail | 81,367 lin. ft. |
| 5. | Track, 70-lb. rail | 195,548 lin. ft. |
| 6. | Telephone line | 213,395 lin. ft. |
| 7. | Piles in trestles | 107,801 lin. ft. |
| 8. | Iron in trestles | 161,926 lb. |
| 9. | Lumber in trestles | 822,380 ft. b. m. |
| 10. | Logs in culverts | 112,559 lin. ft. |
| 11. | Iron in culverts | 12,558 lb. |

Toward the close of the year, funds being practically exhausted, the organization was reduced to a minimum, and aside from a little track laying and the completion of the bridges under course of erection, work was brought to a standstill.

The line from Anchorage to Matanuska River is now practically completed.

### TRANSPORTATION PROBLEMS FOR SURVEY PARTIES AT NORTH END

Operations in the Fairbanks Division consisted simply of location and valuation surveys. A definite location was made from Carlo Creek, Mile 331, to Fairbanks, Mile 466. Toward the close of the season a valuation was made of the 46 miles of the Tanana Valley Railroad running from Chena and Fairbanks to Chatinika in the heart of the mining district. While the surveys themselves presented no serious difficulties, the matter of transportation in the interior is always one of delay and expense. The skeleton parties left Seattle early in May and proceeded via steamer and railway to Whitehorse, thence overland 150 miles around the frozen lakes to Carmacks on the Lewes River, where a steamer was waiting to leave as soon as telegraphic reports showed the river to be clear of ice. On May 22, 1915, the first party was disembarked at Nenana, where waiting packhorses transported them up the Nenana to Carlo Creek. The other party started at Fairbanks and worked to a junction with the first party on the Nenana River. The juncture was made late in September and the parties were disbanded, the engineers proceeding to Seward over the wagon road, to take up office work in connection with their surveys. A final location was made on 135 miles.

### Country Surprisingly "Easy" for Railroad

A matter of wonderment to all engineers is the character of country through which location has been effected. The maximum grades are found in the mountainous Kenai Peninsula, where grades of 2.2 per cent exist in two summits. It is even possible, albeit at great expense, to reduce this grade to a 1.5-per cent maximum, compensated. There exists a short sketch of 2.13-per cent compensated grade near Mile 278. North of Broad Pass, the summit of the Alaska Range, the maximum grade is 1 per cent compensated. Curvature is held down to 10 deg. maximum, except in a very few instances where it approaches 14 deg. Broad Pass itself seems to have been designed to carry a road to the interior country. With an elevation of only 2400 ft. above sea level it lies a great wide gash in mountains towering on either side. To the west stands Mount McKinley, with an altitude of 20,300 ft., to the east are his husky offsprings, reaching in certain peaks elevations of more than 14,000 ft.

With few exceptions difficult construction is confined to Turnagain Arm and the Nenana Canyon where heavy rock work is encountered.

In the enabling Act authority is granted to utilize such equipment from the Panama Canal as may be no longer required on the Isthmus. In pursuance of this authority several thousand tons of engines, cars, track and shop material were shipped to Anchorage and are now there in use.

### The New Town of Anchorage

Another feature of the Act was the power granted to the President to withdraw from entry such townsites along the right-of-way as might be of use to the railroad. A number of such tracts have been withdrawn and on one, Anchorage, a thriving town is already established. For its own use the commission first selected such tracts as were needed, following which a portion of the withdrawal was subdivided into town lots and sold at auction to the highest bidder. A one-third payment was made on the purchase price and the remainder is to be paid in five equal installments without interest. So far the sale value of lots has reached $177,105.

The town is in a rather anomalous position. Title is still vested in the government, and the community has no authority by which its needs can be met by taxation. Unfortunately all money collected from the sale of lots is by law turned into the Treasury of the United States and in consequence the commission, as well as being engaged in the construction of railroads, perforce must look to the welfare of the town. Roads had to be cut and graded, a post-office, jail and schoolhouse built, waterworks installed and sanitary regulations enforced.

In the regulations for the disposal of lots was contained the clause that in no event, under pain of forfeiture, should liquor be sold. That this was a wise provision none can now deny, and as a consequence in this our northernmost possession there exists a railroad construction camp in which disorder seldom appears and the jail is seldom occupied. The few illicit sellers of whiskey have been rounded up and punished.

The financial figures in Table 3, taken from a report of the chairman, will be found of interest to the engineer:

TABLE 3—STATEMENT OF EXPENDITURES FOR ALL DIVISIONS, COMPILED FROM LATEST INFORMATION RECEIVED FROM FIELD

| | | | |
|---|---|---|---|
| Balance remaining from appropriation of $1,000,000 (provided in accordance with terms of Alaska Railroad Act approved March 12, 1914) Feb. 1, 1915, in hands of U. S. Treasurer and special disbursing agents of Alaskan Engineering Commission | | | $607,095.00 |
| Appropriation becoming available July 1, 1915, sundry civil appropriation act for fiscal year 1916 | | | 2,000,000.00 |
| Amounts reimbursed to appropriation, "Construction and Operation of Railroads in Alaska," Feb. 1, 1915, to Nov. 30, 1916 | | | 2,902.30 |
| | | | $2,609,997.30 |
| Total available for expenditures on "Construction and Operation of Railroads in Alaska," Feb. 1, 1915, to Nov. 30, 1916 | | | 2,609,997.30 |
| Expenditures, Anchorage Division, to Nov. 30, 1915: | | | |
| Wharves and docks, Anchorage | | $28,841.00 | |
| Marine railways for repair and storage of floating equipment (included in "Wharves and Docks"). | | | |
| Dredging operations, Anchorage | | 1,099.00 | |
| Terminal yards, Anchorage | | 53,576.00 | |
| Construction of Ship Creek spur line, Anchorage to Ship Creek Junction (4.8 miles) | | 97,927.00 | |
| Construction of main line, Ship Creek Junction to Matanuska River | | 790,406.00 | |
| Machine shops, engine house and other permanent railway buildings, Anchorage | | 19,474.00 | |
| Temporary telephone line, Kern Creek to Ship Creek (Anchorage) | | 7,201.00 | |
| Winter quarters for permanent employees, Anchorage | | 25,747.00 | |
| Wintering live stock | | 4,266.00 | |
| Construction work, Anchorage townsite | | 42,363.00 | |
| Maintenance of hospital, Anchorage | | 11,246.00 | |
| Public buildings, Anchorage (post office, marshal's office, school house) | | 8,310.00 | |
| Construction of winter trail, Anchorage to Bird Point | | 952.00 | |
| Anchorage commercial telephone system | | 2,764.00 | |
| Freight and repairs, equipment transferred from Canal Zone | | 132,390.00 | |
| Cost of floating equipment: Launches, barges, boats, etc. | | 63,657.00 | |
| Location surveys, south end of main line and Matanuska coal field branch | | 77,111.00 | |
| Unapplied construction material and supplies on hand | | 408,837.00 | |
| Total Anchorage Division | | $1,776,167.00 | |
| Note.—The following expenditures for equipment have been included in the cost of the Ship Creek spur line, main line, Ship Creek Junction to Matanuska River, and Anchorage terminal yards: | | | |
| Pile drivers, locomotive cranes, locomotives and cars, track jacks, and track tools | $44,585.87 | | |
| Horses, wagons, etc | 28,673.86 | | |
| Sawmill and sundry machinery | 4,929.20 | | |
| Grading machinery and equipment | 15,551.81 | | |
| | $93,740.74 | | |
| Location surveys, north end, main line, Carlo Creek to Fairbanks, to Dec. 31, 1915 | | 46,793.50 | |
| Payment of first installment on purchase price for Alaska Northern Railway (Aug. 25, 1915) | | 504,188.49 | |
| Commission and headquarters office expenses (to Nov. 13, 1915) | | 76,700.00 | |
| Rehabilitation of Alaska Northern Railway (to Nov. 13, 1915) | | 49,000.00 | |
| Purchasing office, Seattle, Wash. (to Nov. 13, 1915) | | 12,100.00 | |
| Treasury settlements in November (freight bills and sundry miscellaneous items) | | 2,965.17 | |
| Total expenditures as above | | | $2,467,914.16 |
| Known balance (Nov. 30, 1915) from latest available information from the field (unexpended) | | | $142,083.14 |

It must be remembered that the above figures include a very high transportation cost with rates from Seattle ranging from $6.50 per ton on steel rails to Anchorage to $120 for other classification of freight to the interior country. Penalties for heavy pieces are appalling. First-class passenger rates from Seattle to Anchorage are $55 and to Fairbanks $130.

In February, 1916, Congress included in an urgent deficiency bill the sum of $2,000,000, so that the commission might continue its activities until the regular appropriation contained in the Sundry Civil Act should become available. With this amount the summer's supplies are being ordered and contracts for construction being let. It is hoped that by the close of the calendar year a great stride toward final construction will have been made.

Table 4 gives the approximate locations of the various points of interest in miles from Seward.

TABLE 4—APPROXIMATE MILEAGES

| Point | Miles |
|---|---|
| Seward | 0 |
| First Summit | 12 |
| Second Summit | 45 |
| Top Summit | 46 |
| Spencer Glacier | 53 |
| Portage Creek | 64 |
| Kern Creek | 71 |
| Anchorage Junction | 116 |
| Anchorage | 121 |
| Eagle River | 126 |
| Knik River | 145 |
| Matanuska River | 147 |
| Chickaloon (coal fields) | 186 |
| Little Susitna | 167 |
| Willow Creek | 185 |
| Talkeetna | 226 |
| Indian Creek | 268 |
| Broad Pass | 311 |
| Carlo Creek | 331 |
| Riley Creek | 334 |
| Nenana Canyon Head | 345 |
| Opposite Healy Creek (Nenana Coal Fields) | 357 |
| Nenana Bridge | 368 |
| 35-mile crossing | 380 |
| Lost Slough | 390 |
| South side bridge across Tanana | 407 |
| Goldstream, first crossing | 425 |
| Goldstream, second crossing | 454 |
| Happy Summit | 456 |
| Fairbanks | 466 |

### Benefits to Be Derived from Railroad

The principal benefits to be derived from a railroad will be the opening up of coal fields for the use of the people of the United States and Alaska. Nearest the coast on the route of survey lie the Matanuska coal fields. A recent test of a sample from these fields shows the coal to be available for use by the Navy. The coal is a fine-quality, semi-bituminous coal, comparing favorably with the semi-bituminous coals of West Virginia and Maryland. For export purposes this product can be shipped either from Seward all months of the year or from Anchorage for seven or eight months of the year when Cook Inlet is free from traffic-hindering ice. The advantage of shipping from Anchorage is that the haul is 110 miles shorter than to Seward, with practically no adverse grades. With certain harbor improvements to facilitate loading and unloading at all tides, colliers of any size can navigate Cook Inlet during the open season and approach bunkers erected to suit the size of the trade.

One hundred miles from Fairbanks are the Nenana lignite fields. These lignites are low in ash content and high in calorific value. While it is hardly possible that these coals will ever be exported from Alaska, they are well adapted for domestic use.

After ten years of great mining activity around Fairbanks the wood available for fuel has been destroyed within the economic limits of wagon and sled haul, and the mining industry is appreciably slackening. The Nenana lignites will supply the fuel wants, and the lower-grade auriferous gravels will be made productive and profitable. Cordwood in the Fairbanks mining district has now reached the enormous price of from $10 to $16 a cord, according to locality. Lignite should be delivered to the consumer at a maximum price, including wagon haul, of $8 a ton. With a fuel value of one ton of coal to two cords of wood, a saving is effected which makes all the difference between a substantial profit and a bad loss. The average plant in frozen placer mining burns ten cords per day. What a wonderful difference in operating a small low-grade mine whether the daily fuel bill is $40 or $160!

Carpers and pessimists see small profit to be gleaned from a government-owned and government-operated railroad, but the histories of all railroads show that development always follows completed construction. There may be a few lean years, but progress along a line of transportation is sure. In the case of this railroad we have first an assured market for coal at both the northern and southern terminal. On Kenai Peninsula and up the Susitna Valley numerous mines, both lode and placer, await transportation which will reduce the prohibitive costs of crude conveyance. Broad Pass bids fair to become a low-grade lode district with heavy shipments of concentrates. The Kantishna district, once famous for placers, 75 miles west of the lower Nenana, has long held interest as a lode possibility and is even now shipping out antimony ore of a high grade. Sixty miles north of Nenana, where the line crosses the Tanana River, is a new placer camp in the Tolovana country, which may even equal the Fairbanks district; the output to be sluiced in the spring clean-up is variously estimated from $500,000 to $1,000,000. At Nenana the railroad will distribute coal and supplies to the lower Tanana River and to a thousand miles of the Yukon. Fairbanks will be the terminus. The Fairbanks district contains about 5000 people and during the ten years of its life has produced upward of $100,000,000 in mineral wealth, and still the major part of it is undeveloped.

Then there is agriculture. In 1914 the agricultural products of the Tanana Valley were valued at $115,000, and agriculture has hardly started. Alaska, if put to it, can furnish her population with all farm and garden products, and will eventually do it.

It has been stated that ten persons to the mile will pay the operating expenses and maintenance of a railroad. In the near future we will have more than this, and the railroad, which adversaries of the measure have termed "a governmental altruistic experiment", will result in a commercial success.

### Costly Grubbing for Roads

On some of the stretches of the Cascade Highway in King County, Washington, the engineer's report shows that the cost of grubbing stumps from the right-of-way amounted to $400 per acre. This cost is chifly due to the fact that on these stretches of the line there was an unusual number of very large stumps.

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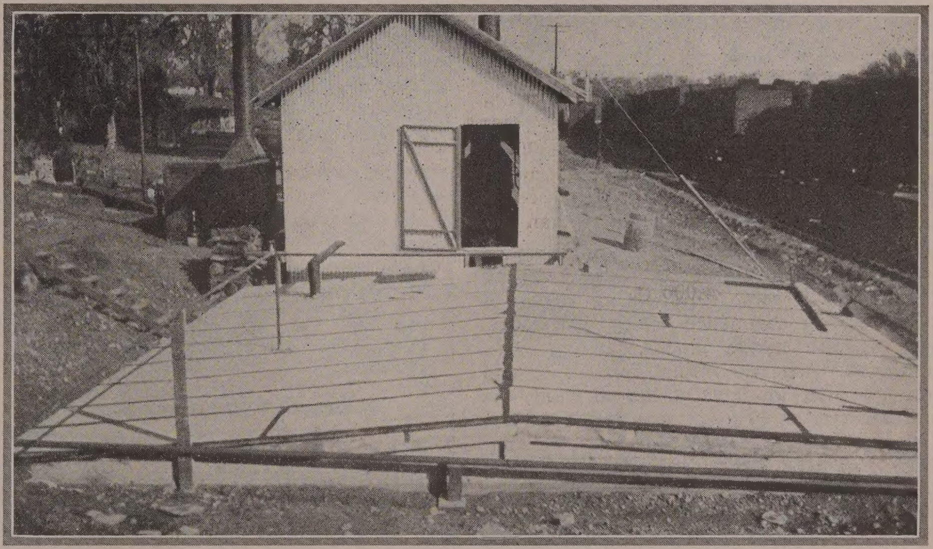
# California's Bituminous Carpeted Concrete Roads Show Durability in Service, Report States

### Division Engineer W. C. Howe of State Commission Reports on First Costs, Construction Methods and Maintenance for "Thin Top" Work

IN spite of predictions of failure for the ½-in. bituminous wearing surface which the California Highway Commission has applied to its 4-in. concrete roads, this type of construction is said to be proving its economy and durability by actual service tests. It appears from a report by Walter C. Howe, division engineer, to Austin B. Fletcher, state highway engineer, that the life of the thin bituminous top will, with moderate repairs, exceed the term of three or four years estimated for it. This conclusion is reached as a result of an experience with 400,000 sq. yd. of surfacing in Division 5 of the state highway system between Salinas and Santa Barbara, all of which, with the exception of a few thousand square yards laid under adverse conditions, is said to be in excellent condition. Mr. Howe discusses the construction methods and costs of this work in the following extracts from his report:



PERMANENT INSTALLATION OF A CALIFORNIA OIL-HEATING PLANT

The covered road oil storage tank in the foreground has a capacity of 25,000 gal. The steam boiler and road oil pump are in the little building, to the left of which appears the oil retort or heater. The motor truck tanks are fed with hot oil from the retorts.

## EQUIPMENT USED AND CREW

The equipment necessary to apply this wearing coat in the most economical manner consists of the following:

1. A semi-portable oil heating plant, one arrangement of which, together with the necessary items, is shown in the drawing.
2. One or two, preferably two, 5 or 6-ton motor trucks, with power dump bodies, one of which is interchangeable with a 1000-gal. pressure oil distributor which is operated by truck motor.
3. One 9-ft. broom, horse-drawn street sweeper.
4. Set of car unloading chutes or portable bunker of sufficient capacity to hold 12 tons of screenings.
5. Lot of small tools such as shovels, round and square point, broad-blade hoes, fibre and steel stable brooms, etc.

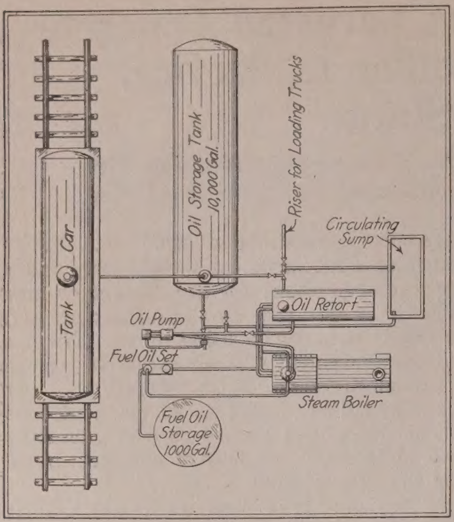
With such an outfit, costing about $12,000, approximately 3000 sq. yd. of completed surfacing can be laid daily under average conditions for about eight or nine months of the year in California; or, say, a yearly output of 600,000 sq. yd. The life of the equipment without excessive repairs is about 5 years. With interest at 6 per cent and depreciation at 20 per cent, this fixed charge per square yard of surfacing would be about one-half of one cent, based on the output noted.

The size of crew used in this work varies from ten to eighteen men, with a two-horse team for the sweeper. The following scale is a fair average of the wages paid to an experienced organization:

DAILY WAGES OF CREW

| | |
|---|---|
| Foreman | $5.00 |
| Oil plant operator | 4.50 |
| Motor truck drivers | 4.00 |
| Oil distributor operator | 3.00 |
| Skilled labor (covering oil) | 2.50 |
| Teamster | 2.50 |
| Common labor (unloading cars, etc.) | 2.25 |
| Two-horse team | 2.25 |

A description of the work on one section of highway is given by Mr. Howe to illustrate the cycle of operations: About two to three weeks before the actual application of oil was contemplated, the two motor trucks were put in service hauling screenings from cars at railroad sidings, and spotting them along the pavement in convenient piles. Two methods of spotting piles of screenings were used, as shown in one of the drawings. At the same time the equipment comprising the oil-heating plant was shipped to the job. A location approximately in the center of the section to be oiled, alongside a railroad siding, was utilized for an oil plant site, and the heating plant similar in arrangement to that shown in the drawing was erected. Four men, a foreman at $4.50 and three laborers

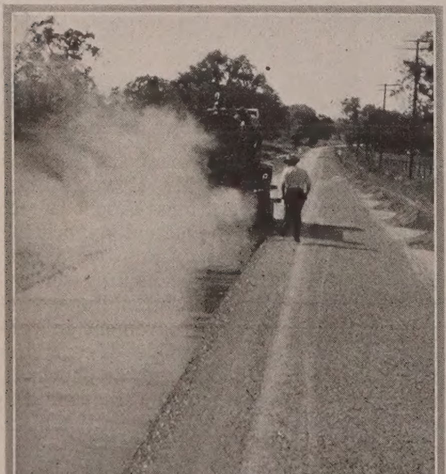


TYPICAL ARRANGEMENT OF OIL-HEATING PLANTS ADOPTED ON CALIFORNIA'S HIGHWAY COMMISSION'S THIN BITUMINOUS TOP WORK

at $2.50 each, made the complete installation in ten days.

A few days before the arrival of the first car of oil a crew of eight men, each equipped with a hoe, a square point shovel and a stable broom, went from one end of the pavement to the other, scraping loose and brooming off all earth and detritus adhering to the pavement. Tightly-packed earth and manure will not be removed by the rotary broom. Everything being in readiness to commence oiling operations, one of the motor trucks, having been equipped with the oiling apparatus, and hot oil being available at the oil plant, the pavement crew (8 to 10 men and two-horse team on sweeper) prepared a strip of concrete one-half the pavement width for a length of 4400 to 4500 ft., by careful brooming, to remove dust film and dirt. One of the most important steps in placing this surfacing is this work of cleaning the concrete, and it must be done thoroughly.

The hot oil was then sprayed on this strip at the rate of ¼ gal. per square yard, the oil being at a temperature of 275 to 325 deg. Fahr. at the time of application. The pavement crew, strung along with 300 to 400-ft. intervals between the men, immediately covered the oil roughly with a light coat of screenings, and as soon as the oil was completely covered the horse-drawn sweeper, with broom locked against revolving, was driven back and forth the length of the strip until the screenings presented a smooth, uniform appearance. The traffic was then turned on to this oiled and screened strip and the remaining half of the concrete pavement was closed to traffic and cleaned to receive its coat of oil.

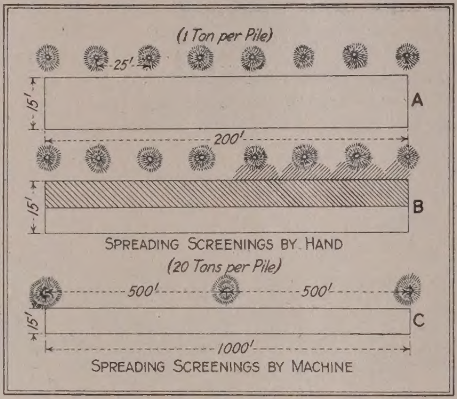


HOW THE HOT OIL IS APPLIED TO THE CLEAN CONCRETE SURFACE OF THE BASE

### OIL APPLIED IN STRIPS

In this manner—a single application of ¼ gal. of oil per square yard in successive strips, each about 4200 ft. in length, first on one-half and then on the adjoining one-half of the pavement—the work was carried forward until the entire pavement had received a first coat of oil and screenings. Traffic was allowed to pass over a strip as soon as it was thoroughly covered with screenings.

A second coat of oil and screenings, exactly similar in quantity and method, was then applied over the whole section on top of the first coat, care being used to sweep the initial covering clean of loose screenings or dust before applying oil. With the completion of this second coat the bituminous surfacing was practically abandoned to traffic, one man and a small wagon and horse being left on the work to add additional screenings wherever oil showed signs of working to the surface. This care against "bleeding" was maintained for about three weeks, and in a short time thereafter the traffic had given the surfacing a smooth, uniform asphaltic appearance.



TWO METHODS OF DISTRIBUTING SCREENINGS ALONG ROADS

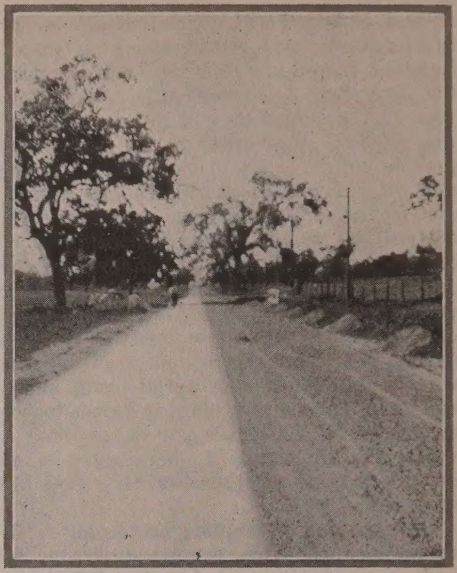
In the upper sketch one strip of concrete base, 7.5 ft. wide, has just been oiled, and laborers are throwing screenings on the fresh oil from the small stock piles as shown by the shaded area. In the lower sketch a small hopper discharging into a 30-in. revolving disc, suspended horizontally, is attached to the rear end of the motor truck dump body. Two laborers with truck feed screenings to hopper and load trucks from stock piles.

The use of coarse sand for the second coat, in place of screenings, has been tried with apparently satisfactory results, but it is Mr. Howe's belief that the use of good, hard broken stone screenings, free from the dust of fracture, for both coats of oil will make a more lasting and satisfactory surfacing than the sand.

### COST OF SURFACING

A brief summation of costs of the surfacing above described is given. These items of cost are averages taken from seven different jobs, the smallest of which covered 12,800 sq. yd., and the largest 116,000 sq. yd., the total being about 400,000 sq. yd.

The table includes the cost of all repairs to equipment, together with the full cost of all incidental tools, etc.



ONE STRIP OF PAVEMENT HAS JUST BEEN GIVEN A COAT OF OIL AND SCREENINGS

It has been freely prophesied that this surfacing will have a life of from three to four years with moderate repairs. That it will have even a longer life, Mr. Howe believes, is now very probable, and such repairs as have been made in the case of the 400,000 sq. yd. previously mentioned, will amount to less than $200, or about $0.0005 (one-half mill) per square yard. Some of this surfacing is almost two years old. With the exception of one small piece of surfacing containing a few thousand square yards, which was improperly put down due to adverse conditions, all of the 400,000 sq. yd. is in excellent condition.

AVERAGE COSTS OF BITUMINOUS SURFACING

| | Per sq. yd. of Pavement |
|---|---|
| *Unloading screenings | $0.0035 |
| Hauling and piling screenings | 0.0130 |
| *Spreading screenings on oil | 0.0037 |
| *Unloading tank cars and heating oil | 0.0056 |
| Hauling and spreading oil | 0.0050 |
| *Cleaning surface to receive oil | 0.0040 |
| Screenings (cost f.o.b. cars R. R. sidings) | 0.0325 |
| Asphaltic oil (cost f.o.b. cars R. R. sidings) | 0.0142 |
| *Interest and depreciation | 0.0045 |
| *Supervision and overhead | 0.0025 |
| Total cost per sq. yd. | $0.0885 |
| On approximately 1c. per square foot. | |

*These items vary but little no matter what the location of the work. Other items are variable and depend upon length of haul, nearness to sources of supply, etc.

An expensive surfacing would very quickly have exhausted the $18,000,000 highway bond issue fund, while replacements of the thin bituminous surfacing can be made from year to year as necessary from the maintenance fund provided by the motor vehicle tax. The people thus directly benefit by the increased mileage of permanent smooth highway over which they may travel.

## Forms on Louisville and Portland Canal Wall—A Correction

The forms for the wall of the Louisville and Portland Canal at Louisville, Ky., the construction of which was described in the Engineering Record of April 15, page 524, held from 60 to 200 cu. yd. per 40-ft. section, instead of 7½ cu. yd., as a typographical error made the article state.

# Engineer's Work Puts Community Building on Sound Economic Basis

### Chambers of Commerce Must Base Their Industrial Work on Thorough Engineering Investigations if They Are to Prove of Permanent Benefit

By JAMES Z. GEORGE
Industrial Engineer, New Orleans Association of Commerce

THE FIRST fifteen years of the twentieth century have witnessed an awakening to the availability of the engineer for work outside of the mere design and construction of machinery or structures. Those with dollars at stake, or problems to solve, have come to an appreciation of the usefulness of the concomitant imagination, ingenuity and good judgment of the man of well-rounded engineering education and experience. The ability to visualize the abstract and plan and execute it into the concrete, and do it all systematically, has won him a welcome in all walks of life.

The work here spoken of, and to which the attention of the engineering profession is directed, is in connection with the institutions charged with the upbuilding of the commercial, civic and industrial interests of communities—the chambers of commerce, as they are usually called.

## INCEPTION OF CHAMBERS OF COMMERCE

The inception of these institutions was almost wholly as a "booster" organization for the purpose of advertising the community. Good was accomplished even by these earlier organizations: the mere getting-together of the leading men in any community is potentially good. Also, many industries were induced to move to, or were organized in, these "boosted" cities, with the help of free sites, nontaxation or cash bonuses. Some of these plants have made good, but most every center I have ever visited has one or more "booster" industries, now boarded up and surrounded by rust and weeds.

The greatest benefit the "booster" clubs conferred was the germination of the seed which has grown into the tree of the saner, more businesslike and efficient community-building chamber of commerce of 1916.

## NEW IDEALS

The present and ever-growing demand is that the chamber of commerce be a leader and not a follower; that it render a real service to the community. A very serious call is made on the chamber of today. New industries! More industries! To open up new lines of trade and use more of the available raw products at hand; more and larger payrolls to buy the local merchant's goods—in order that the community may attain industrial supremacy.

But, besides the work in developing industries already in the community or bringing new ones in, there is a legion of other opportunities. Better service from local public-service corporations, favorable transportation rates and service, local-traffic interchange facilities, first-class sanitation, good roads and streets; welfare work, including housing, city planning, parks, playgrounds, employment, wages—all these and more are fit subjects for the chamber's action.

Can the engineer-economist be of service in this work? After eight months' close study of, and experience in, the situation the writer unhesitatingly says he can. What other vocation so fits one for such a multiplicity of duties? A statement of the qualifications necessary is attempted, but with some misgivings.

## QUALIFICATIONS NEEDED

These qualifications are education, experience and temperament. Education is, of course, very important; not merely the education got within college walls, but rather the interested reading, study and data-collecting of the years, paralleled by practical work. This must have included not only subjects bearing directly upon design, construction and operaton of enneering works, but collateral or allied and human-interest subjects as well.

Experience is more or less parallel with education. Of course, the experienced industrial engineer's training is of great value in this work. But the writer does not consider the field closed to the other branches of engineering. What broader training does anyone get than in the multifarious phases of large construction or operating work? These institutions do not need so much the actual engineering ability of the technician, as that general, well-rounded education and experience which comes from years of encounter with engineering problems and works.

The final qualification is temperament. Putting this last does not mean a lessening of its importance. The writer does not know of a work that requires more *sauviter en modo*, and at the same time aplomb, than does this one.

The more need there is for the industrial engineer in the building of a community, the more radical are his ideas going to appear. Hence, only the most patient work to educate those interested and the community to these needs will insure success. It means, further, a need for most careful and painstaking preparation before any suggestion is offered. Again, it means the ability to enthuse others in the work to be done that the engineer may have the co-operation. This is most essential in community work.

## WORK AT NEW ORLEANS

It will no doubt be of interest to know a little of the work and aims of the industrial engineer of the New Orleans Association of Commerce, which, so far as is known, is the first position of its kind in the United States.

The manager of this institution was the first to get the "vision" of this new order and to realize that community building, to be sound and lasting, must proceed along strictly economic lines. As a part of his plan, in August, 1915, the writer was appointed to the position of engineer-in-charge of the industrial department, and also of assistant general manager of the general organization. The appointment was no doubt owing to the fact that for nearly two years he had been the investigating engineer for the consulting engineers of the port, in the preparation of several important reports, necessitating a close study of this city from a commercial, transportation and industrial standpoint. This statement is made to show that while in the position only eight months, the engineer has had the advantage of several years of study of conditions surrounding industrial development at New Orleans.

## FIRST WORK

The first work undertaken was a complete engineering report on the organization and operation of the New Orleans Association of Commerce. To do this required a careful investigation of like institutions. The first step was to make a chart comparing this association with many others in the matter of total revenue, revenue per capita of population, members per capita, percentage of losses in collections, etc., etc. After finding by comparison just its status, it was then possible to make suggestions. These ran all the way from the installation of a modern filing system to the creation of new departments and the broadening of the services of those already in operation. This report and plan of organization has been adopted by the manager as the "bible," as he calls it, for 1916.

In the new plan adopted the position of the industrial engineer in the general organization is about that of "works manager," thus relieving the general manager of all details of operation of the departments and "machinery." This scheme, of course, gives the general manager more time for broad development and policy work.

## PLAN OF ACTION

The first principle enunciated was that while every effort would be made to bring in new industries, the greatest effort should be made to expand the individual industries already located here—some 900 in number, large and small. The factory already operating and making good in a small way has evidently passed through the experimental stage and it is in many cases easier to help it to expand its output and thus employ more men and distribute a larger product than to bring another factory in.

Industrial or efficiency engineering, as practised in the northern and eastern industrial centers, is, generally speaking, unknown here. There is not, to the writer's knowledge, an efficiency engineer, capable of advising on organization, production, wage scales, etc., as yet in general practice in this section. Of course, it is utterly out of the question for this department actually to study and assist in bringing each individual plant up to efficiency. The aim is to educate and advise only, to prepare the field for the practising industrial or efficiency engineer.

To accomplish this, those members of the association who are interested in industrial economy are being asked to affiliate with the industrial department. When this has been even partially accomplished we will be in a position to study more carefully the individual and mass needs.

To begin this educational work, a series of lectures by the best experts of the country on the subjects of organization, production, cost accounting and selling was arranged for.

In addition to this, arrangements have

been made for the publication monthly of brief pamphlets. The first is on "Industrial Development at New Orleans." The others will include "Efficiency," "Safety," "Fire Prevention," "Data Filing," etc.

### FINANCIAL GUIDANCE AND HELP

In handling specific services to members the executive committee of the department has been divided into numerous sections, such as industrial, finance, safety, fire prevention, employment and opportunities, etc. Committees have also been appointed to study the possibility of by-products for certain of those industries now operating here.

Many industries already in operation will need more capital if they would expand. New industries to be organized here, and those coming from other points, will also need financial guidance and help. To render this service a special section of the executive committee of the industrial department has been organized, consisting of a prominent business man, a large manufacturer and the president of a bank. These three, sitting with the chairman of the department, examine and pass on the merit of such of these propositions as are brought before them. Before putting a proposition up to this committee the writer makes a very full investigation and engineering report on the promoters and the possibilities of the project. If the committee approve the proposition, the report and a statement of approval is then mailed out to the members of the association. This service is to take the place of bonuses. That it will prove valuable is guaranteed by the ability of the committee investigating and approving the proposition.

### BRIEFS FOR NEW INDUSTRIES

In attracting outside industries, instead of sending broadcast general claims as an industrial center, those industries in which supply of raw materials, transportation, markets, etc., are most attractive here have been selected, and engineering briefs on these subjects are being prepared. Under this plan the economies must be developed to the highest point, otherwise industries will not be attracted. And while probably a little slow, this procedure is absolutely sound and will win.

This same reporting service is also rendered to members who contemplate the organization of some particular industry.

### MISCELLANEOUS SERVICES

The industrial department is also investigating the local conditions surrounding loans to workingmen, with the idea of developing a remedial loan bank.

Space does not permit detailing here the many other specific services planned and to be developed in this department as quickly as the demand and financial strength make it possible to do so.

In addition to the work within the association of commerce and its industrial department, as a representative of this institution, the industrial engineer is also a member of a public engineering committee which is investigating and planning a public work of great interest and magnitude.

In fact the work for the engineer to do in community upbuilding is limited only by the ingenuity and good judgment of the engineer. It is pleasant work, too, for many reasons, chief among which is that it is a constructive public benefaction—a phase that the writer is sure appeals very greatly to the engineering profession.

The writer sincerely hopes that other engineers will join in this work and thus further demonstrate to the public the capacity and adaptability of engineers for work of the broadest character.

# Are National Express-Freight Companies Needed?

**Could They Not Effect Systematic Delivery of Freight to and from Terminals, and Eliminate Present Congestion?**

**By A. JACKSON MARSHALL**
**Secretary, Electric Vehicle Section, National Electric Light Association, New York City**

IS THERE NOT a field for national companies, comparable to the express companies, to handle freight to and from large railroad and steamship terminals?

The costly congestion of freight at railroad and steamship terminals has reached such proportions that before long remedies will of necessity have to be evolved. A study of the problem would indicate that railroads and steamships are carrying freight most efficiently between points, but the handling of merchandise to and from and in the terminals leaves much to be desired. It therefore appears that changes will have to be effected in the transportation of freight to and from the terminals and in the handling of merchandise in the terminals themselves. While great improvements have been made, much more could be effected in these two phases of local freight handling.

It seems to the writer that the full measure of possible success can be obtained only when the local transportation and the handling of freight in the terminals are considered jointly, instead of as two separate and distinct phases. No matter how perfectly developed the method of freight handling in the terminals may be, the highest efficiency cannot be obtained unless the movement of freight to and from terminals by trucks be such as will exactly fit into the scheme of terminal operation and vice versa.

It is apparent that the local transportation of freight is unsystematic and very costly. It is hardly necessary to review the chaotic conditions existing in this branch of the work, which seem to get worse instead of better. Almost everyone is familiar with the losses resulting from the influx and outflow of freight during certain hours of the day at the terminals, and the inactivity at other periods, due to the fact that nearly everyone wants service at the same time, which it is a physical impossibility to render. The thousands of trucks compelled to wait their turn pile up a loss that is counted in the tens of millions.

### WHY NOT NIGHT OPERATION?

If each truck had a definite time to call for or deliver merchandise to terminals and the schedules were observed, the terminals perhaps operating by night as well as by day, delays and losses due to congestion would be reduced to a minimum. Furthermore, trucks and trailers could systematically operate better at night, since they would not be compelled constantly to buck street traffic with attending delays and accidents. Sooner or later the growing traffic of our cities will force the use of streets at night. There is hardly more reason why the streets of our city should not be used at night, especially for the transportation of freight, than there would be to confine the use of railroad tracks to day traffic.

If the existing trucking individuals and concerns could get together and work out a method of co-operating systematically in the development of a scientific schedule of operation, much could be accomplished. Otherwise it appears that the railroads must either go into the delivery of freight direct from shipper to consignee, or that large and efficient local transportation companies will have to be formed to work sympathetically with the railroads in the elimination of freight congestion, with its attending losses. No matter what method or methods may be employed, action, and prompt action, is imperative.

### NATIONAL EXPRESS-FREIGHT COMPANIES

The more thought the writer gives to the subject, the more it appears that organizations possessing the qualifications of efficient express companies would prove to be the solution, for such organizations would have an intimate and practical knowledge of railroading, understand the receipt and dispatch of merchandise through terminals, have national and international organizations and the connections necessary to the forwarding of freight, and know the local transportation phase of the work. Furthermore such a development would not be in the nature of an entirely untried experiment, for the transference of express is not so unlike the handling of freight, except that the latter is somewhat more bulky and usually does not move so rapidly. But it is the writer's personal opinion that the costly congestion of freight could be materially eliminated and far-reaching economies affected if organizations similar to express companies would go into the business of express freight, possibly operating their own terminals and fleets of motor trucks for local transportation, operating along the same general lines employed in the handling of express.

The idea of national organizations competent to handle the freight business on much the same basis as express has been handled seems to be such a simple solution of the problem that the writer has hesitated heretofore to give public expression to it, fearing that it had a weak spot unknown to him which possibly prevented others, better informed, from having expressed the thought before. However, the idea is advanced for whatever value it may have, and if it is not feasible, the fact will shortly be known. The details incident to such a development could be worked out if the main thought is acceptable.

## Railroads Teaching Road Making

The first "good roads special" of the Chicago, Burlington & Quincy Railroad started April 11 on a five-day tour through Iowa. It carried government officials and lecturers in the employ the State, who gave talks and demonstrations, and also a complete exhibit of road-building machinery and models of all kinds of roads from dirt to hard pavements. The special was composed of audience and exhibition cars in which the lectures and demonstrations were given free to the public in each of the towns and cities visited.

# Does Present-Day College Education Produce Accuracy and Thoroughness?

### A Discussion Between Professors George F. Swain and Daniel W. Mead Arising from the Former's Strictures on College Graduates

[*As a contribution to the discussion on the decrease in the registration of students in civil engineering, Prof. George F. Swain severely criticised present-day college education in a letter to the editor of the Engineering Record, published on page* 291 *of the issue of Feb.* 25. *Professor Swain's contention was that many go to college who are not fitted or disposed to benefit by the instruction. That fact, combined with collegiate standards of attainment below those of the business world, produces men who, on the average, know nothing accurately and thoroughly. Prof. Daniel W. Mead differed emphatically with Professor Swain. He has expressed his disagreement in the letter published below, to which, at the request of the Engineering Record, Professor Swain has replied. The reply also appears here.*—EDITOR.]

## Professor Mead's Criticism

*Professor Mead's criticism of Professor Swain's position is as follows:*

I WAS much surprised at the extraordinary communication from Professor George F. Swain, contained in your issue of Feb. 26. If what Professor Swain says is true, the wisdom of continuing the engineering schools of the country, or at least any schools to which such remarks justly apply, would seem doubtful.

From over thirty years of practice over most of the United States and personal contact with many hundred engineering graduates of various engineering schools, more than a hundred of whom have been in my own employ, I desire to go on record in direct opposition to most of the statements made by Professor Swain. My acquaintance and experience have been confined largely to the schools and graduates of the Central States, and my opinion must be regarded as based on such acquaintance and experience. If the schools of the East can accept as valid the assertions of Professor Swain, they certainly have cause for immediate and profound reform.

### TECHNICAL COURSES DIFFICULT

It is undoubtedly true that many young men from families in good circumstances enter college as a matter of course, and without any adequate desire for knowledge or training. Such men, at least in our Western colleges, seldom enter the technical courses, which are uniformly noted as the most difficult in the college curriculum; or if they do, seldom follow such courses for more than the first year or two.

In my opinion, the great majority of technical students, even though they do not continue in technical lines, are greatly benefited by the training they receive. For men who are to take part in practical business life, a technical course is greatly superior to the classical or even to the general college courses. All will doubtless agree that if the thoughtless and heedless young men who, on account of conditions, are more often found among the sons of rich men, could be set to work and brought to realize the duties and responsibilities of life instead of wasting their time either in college or society, they as individuals, and the nation as well, would be better off. It is not believed that the decrease in attendance at technical schools is from this class.

There is no doubt that an earnest young man can secure much valuable information from a correspondence course, a night course, or by individual study without outside instruction; but it is equally true that the same man, with the energy to do such work under adverse conditions, can and would gain still greater advantages from the personal instruction afforded by a course in any good technical school.

### ACCURACY AND THOROUGHNESS

Professor Swain's remarks on accuracy and thoroughness are unwarranted. He has confused skill in particular operations, which can result only from extensive practice, with the actual qualities of accuracy and thoroughness. Skill or accuracy and thoroughness in the application of technical training, like other similar individual characteristics, are highly desirable qualities and should be inculcated so far as conditions warrant. All such attributes while important are only incidental to technical instruction. Only a certain amount of time can at the best be devoted in a technical course to attaining these desirable ends, and a curriculum largely devoted to their acquisition would degenerate into a business course, valuable in itself for certain definite ends but neither to be expected nor desired as the sole or even the principal aim of technical education. Other things are no less essential in college work, and skill, accuracy and thoroughness, like practical experience, knowledge of men, and breadth of education, must largely be left to be developed in practical life. Even a limited consideration of education should lead to the conclusion that four years in a technical school cannot be expected to lead to accuracy and thoroughness, to logical thinking, or to close observation in any special line. Four years' training in a trade, in business, or in a trade or business school where the student devotes his entire attention to a single line of work, would undoubtedly lead to better results along that specific line; but the training would not have the breadth demanded in a technical course.

The college standard of accuracy and thoroughness is not established by the students but by the instructors, and if the present standard in any engineering school is open to criticism, such criticism must be directed to the engineering faculties rather than to the students. It is possible that more time and energy should be devoted to such work in all technical institutions.

### ACQUAINTANCESHIP AND ATHLETICS

If "the greatest benefit which most men derive from college comes from the acquaintances which they form, and the discipline they get from athletics," then our technical schools must indeed be regarded as failures. Association with others is indeed an important part of college education, but in the schools of the Central States comparatively few technical students take active part in college athletics, and hence such advantages are comparatively insignificant. It is indeed questionable if in the majority of cases the athletic side is not more of a detriment than a benefit, at least when much time or energy is devoted to the same.

It is probably true that many college men have an unwarranted idea of their own abilities, and this can be remedied only by actual contact with life. In this they do not differ largely from college professors or others who have not mingled largely with practical affairs. No man has a fair opportunity for self-knowledge until he is able to compare himself with others in the real problems of business or professional work.

### CONCEIT AND COMMON SENSE

The common idea of the self-conceit and self-assurance supposed to be possessed by the graduates of technical colleges is largely erroneous. It has been repeated until it has become a popular fallacy. My personal contact with large numbers of young men both in and outside of college does not warrant the opinion that as a rule they possess this characteristic to any objectionable degree. Neither does my experience substantiate the statement that an engineering education is detrimental to the native common sense of young men. Freshmen in technical schools are not noted for any conspicuous development of this faculty; neither are our technical graduates more deficient in this line than should normally be expected from their environments. Common sense can be developed only by contact with real practical experience; it cannot be largely developed in technical schools, but even a fairly well balanced course is not detrimental to this faculty. Only men from those institutions that are too highly specialized have to unlearn the subjects taught in any first-class school.

It is true that in a general course the student does not acquire any great knowledge of any specialty; if he has become interested in the subject and has learned how to study it, he has learned all that is necessary or desirable when the purpose and extent of the course are considered.

### PURPOSE OF A TECHNICAL COURSE

Much of the unthinking, popular opinion of college work arises from an apparent lack of an appreciation of the purpose of a technical course and what results should be expected therefrom. I have outlined in another place my conception of the elements of an engineering course as follows:

"All who have given much thought to the subject of education will agree that . . . the purpose of technical education is not so much to impart technical knowledge to the student as to furnish the training which will enable him to understand and investigate the conditions which surround a problem, to determine the fundamental principles on which its successful solution depends, to ascertain and analyze the elements which influence or modify it, to design the structures and works needed for its successful development, and to supervise the proper construction of such structures or works and carry them to a consummation of successful and economical completion.

"For the purpose of technical education instruction is required:

"1. In the fundamental principles of those sciences on which the practice of the engineer necessarily depends.

"2. In those methods and calculations which must be applied in such practice.

"3. There should be included to as great a degree as possible instruction in those human elements that concern the personal relationship of the engineer with his fellows, with his clients, with contractors, and with the public, and also those matters of judgment, equity and ethics upon which the highest success of the engineer depends no less than upon his technical knowledge."

### HANDICAP OF OLD IDEAS

That our technical schools fall far short of the best that can be done must be admitted. The effect of old educational ideas still handicaps technical work. Too much time is devoted to foreign languages, which in the large majority of cases is of doubtful benefit, while the study of English, which is largely essential to professional preferment, is neglected. Mathematics and the sciences are taught in too abstract a manner and their concrete application is often neglected. In many cases, the courses prescribed are unbalanced and they are frequently too special.

There may be, and probably is, a considerable difference in the attitude of instructors toward the student in different institutions and in different parts of the country. The best training in ethical and moral principles obtains when the student has opportunity for intimate personal contact with his instructors both in and outside of the classroom. No such advantage obtains where lectures are entirely formal, and such opportunities seldom exist in active business or professional work where the man gains his information only in the school of hard knocks.

I agree fully with Mr. Swain that "more moral training and more discipline" are needed; but this and other betterments can be accomplished better by intelligent and united effort than by captious criticism.

## Professor Swain's Reply

*To this criticism by Professor Mead, Professor Swain replies as follows:*

I THANK the Engineering Record very much for allowing me to see the letter from Professor Mead and to send my reply so that the readers may have both in the same issue.

In order to make the issue clear, let me summarize in a few brief statements the opinions which I expressed, and then proceed to consider how Professor Mead meets these statements.

### SUMMARY OF PROFESSOR SWAIN'S POSITION

The opinions I expressed were the following:

1. A large proportion of the students in our colleges and engineering schools would do better for themselves if, instead of going to college, they went to work and earned their own living.

2. The collegiate standard of accuracy, thoroughness and achievement is lower than that of the commercial and business world.

3. The *average* college graduate knows nothing accurately or thoroughly, cannot think logically or observe correctly, has not gained habits of accuracy, and does not know how to obey orders. His knowledge is a half knowledge of many facts, but he does not see them in the right proportion, or know how to use them.

4. It is not infrequent that a college or engineering education has educated nearly all the common sense out of a man.

5. Probably the greatest benefit which most men derive in college comes from the acquaintances which they form, and the discipline they get from athletics.

6. A young man who goes to work instead of going to college, who learns in his work what he needs in order to rise above his fellows, and who supplies this need by correspondence courses, or by night courses at some of the available institutions, will be apt to acquire more real knowledge than the average college graduate.

7. The average college graduate does not realize his limitations, and often goes into the world with a good deal of conceit and unwarranted self-assurance.

8. Our colleges and engineering schools offer great opportunities for those who are able to take advantage of them, but many of those who attend do not know how to take advantage of them, or do not desire to do so.

9. There is a tendency observable in some of our colleges to consider that any student should be able to graduate, and to look upon the failure of a student as largely the fault of the instructor. There is also a tendency, even if unconscious, to measure success by numbers. As a consequence, our colleges and engineering schools are turning out large numbers of routine rule-of-thumb men.

10. What is needed is more moral education and more discipline, for the entire body of boys and girls, and less so-called higher education. A decline in numbers in our higher schools, therefore, would only be a matter of regret if accompanied also by a decline in average ability.

### "WISDOM OF CONTINUING SCHOOLS"

Professor Mead begins with the statement that if what I say is true "the wisdom of continuing schools to which such remarks justly apply would seem doubtful." This conclusion is illogical, for it would, of course, be folly to discontinue a school which can do much *for those students who are able to take advantage of its opportunities.* Professor Mead probably would not argue that because an electric-lighting plant delivers in light but a very small proportion of the energy of the coal, the wisdom of continuing the plant would "seem doubtful." A thing may be in the highest degree worth doing though its efficiency be small, because the thing that it does accomplish is so valuable.

Taking now the previous summary of my opinions, let us see how Professor Mead answers them.

1. Professor Mead seems to agree with this opinion. He says "it is undoubtedly true that many young men . . . enter college as a matter of course and without any adequate desire for knowledge or training." Also "all would doubtless agree that if the thoughtless, heedless young men . . . could be set to work . . . . instead of wasting their time either in college or society they . . . would be better off." This is precisely what I stated. Professor Mead and I might not agree as to the proportion which such young men form of the whole, and of course this is variable. Professor Mead says "the great majority of technical students . . . are greatly benefited by the training they receive." This is probably quite true. The question is whether they would not be *more* benefited by a training in the "University of Hard Knocks." My belief is that a large proportion of students do not receive benefit enough to pay for the cost.

### STANDARDS OF ACCURACY AND ACHIEVEMENT

2. Professor Mead thinks this statement is unwarranted and says that I have "confused skill in particular operations which can result only from extensive practice, with the actual qualities of accuracy and thoroughness."

The word "skill" does not appear anywhere in my letter. It is rather surprsing to accuse me of implying that engineering schools should teach details and the acquisition of "skill in particular operations" which can only come from practice, rather than teaching fundamental principles, considering that all my life I have urged the opposite. A student in college, however, should aim to acquire habits of accuracy and thoroughness, and should know his fundamental principles accurately and thoroughly, and my observation is that the standard in these matters which will enable a young man to graduate from almost any college or engineering school is a standard which in practical business would cost him his job.

Professor Mead says that the college standard of accuracy and thoroughness is not established by the students but by the instructors, and that possibly more time and energy should be devoted to these things. The source of the standard has nothing to do with the question, but I quite agree with the last statement.

### ACCURACY AND THOROUGHNESS

3. Professor Mead apparently agrees entirely with this opinion. He goes farther and says that four years in a technical school *cannot be expected* to lead to these qualities. It is true that he refers to acquiring these qualities in some "special line," and thinks, apparently, that "breadth" is better than to so acquire them. If this is his meaning, then he fails to see that the qualities referred to are universally applicable. A man who can reason logically can reason logically in any subject; a man who has the habit of accuracy, carries it into all that he is called to do. Hence the importance of gaining these qualities. If Professor Mead thinks that a smattering of many things, without these qualities, is better than these qualities themselves, I think he will find few to agree with him, and in my opinion such a view is educationally vicious in the extreme. Anyway, Professor Mead admits that a college or engineering course does not give these qualities, and so he agrees with me.

4. With reference to this, Professor Mead somewhat misinterprets my words. If in his experience as a teacher, however, he has not frequently encountered cases in which the extensive and abstract study of mathematics and the other subjects in our engineering curricula has injured the student's practical common sense, his experience has been very different from mine.

### ACQUAINTANCESHIP AND DISCIPLINE

5. The opinion here expressed will, I am sure, be supported by a great many college and technical graduates who have reached the age when they can look back and form a fair judgment of the value of their college course. I believe that discipline is sadly

lacking to-day in most of our colleges. In athletics, however, the student is *obliged* to submit to discipline, and it greatly benefits him. I have heard of some business houses which make a practice of choosing the college men they employ from among the students who have been prominent in athletics.

Furthermore, it does not logically follow that if my opinion is correct, our technical schools must be regarded as failures, because even if *most* men derive their greatest benefit from the sources which I have stated, there would still be a very large number deriving much benefit in other ways. Besides, the benefit of a large acquaintance is a very real one.

I am no advocate of the extensive indulgence in athletics, and quite agree with Professor Mead that such excess would be a detriment.

6. Professor Mead touches this statement, and admits that an earnest young man can gain much in the ways that I have stated, but thinks that the same young man would gain still greater advantages in a technical school. The trouble with Professor Mead's argument here is that the *obstacles* which the young man encounters in his daily work spur him on, and make him see the necessity for perfecting himself still further, and moreover, make him see more clearly just what he needs; whereas the same man starting in an engineering school assumes an attitude of submissive receptivity, and lacks the spur, the obstacle and the vision.

Some sort of combination of practical work with college education might be very beneficial in this respect, and I am inclined to look upon the work which is being done by Dean Schneider at the University of Cincinnati as one of the most promising developments in modern technical education.

### Conceit and Self-Assurance

7. With reference to the seventh point, Professor Mead agrees with me, saying "it is probably true that many college men have an unwarranted idea of their own ability," and yet thinks that the idea that they possess self-conceit and self-assurance is largely erroneous, and that they do not, as a rule, possess these qualities to any objectionable degree. I did not state that they possessed these qualities "as a rule," or to an "objectionable degree," but I am quite content to let my statement remain as it was written, feeling sure that it will be agreed to by the majority of those who have observed the average new-fledged college graduate.

8. Professor Mead apparently agrees with this statement for he does not take exception to it. I quite agree with his own statement as to what an engineering course should be, and I have many times emphasized essentially the same ideas.

Professor Mead does not take exception to my ninth statement, and agrees with my tenth.

In the opening portion of his letter, Professor Mead states that his own experience has been largely in the schools of the Central States, and this leads me to remark that I do not believe that there is any essential difference between the colleges and technical schools in different parts of the country. This opinion is based on my long experience with students from almost every section of the country, and from most of our universities.

Professor Mead implies that my letter is an instance of "captious criticism" and that improvement in our educational system, which he agrees is needed, can be accomplished better by intelligent and united effort. To this I will say that my letter was not a criticism, but a mere statement of opinion. If every teacher were conducting a business and employing the product he turned out in the school, he would see the school work in a different light. Of course, engineers like Professor Mead and myself do employ our own graduates, yet we naturally differ somewhat in our judgments. However, Professor Mead apparently agrees with six of my ten opinions, and is illogical in his disagreement with some of the others.

### What Others Think

As a matter of fact, opinions quite as strong as mine, and even stronger, are exceedingly numerous, and from sources of highest authority. Professor Mead and other readers of the ENGINEERING RECORD may be interested to read the following quotations.

Herbert Spencer said (Autobiography, Vol. 1, p. 388):

"The established systems of Education, whatever their matter may be, are fundamentally vicious in their manner. They encourage submissive receptivity instead of independent activity."

Ruskin expresses his opinion of modern education as follows (of King's Treasuries):

"Modern education, for the most part, signifies giving people the faculty of thinking wrong on every conceivable subject of importance to them."

Mr. Abraham Flexner. in an interesting book entitled "The American College," uses the following language:

"Now, as a matter of fact, the college does not even rise to the accepted standards of the commercial world, to whose demoralizing influence its scholarly ideals are occasionally alleged to have succumbed. For college standards of success are actually below those that prevail outside. A youth may win his degree on a showing that would in an office cost him his desk."

President W. H. P. Faunce of Brown University, made the following statement:

"The young people of today, as compared with those of fifty years ago, are chiefly deficient in power of sustained attention and original thinking. They cannot, or at least they usually do not, think as clearly, as patiently, and as cogently as did their fathers. They do not as quickly distinguish the irrelevant from the pertinent, the kernel from the husk, as the men of the last generation. They have an amazing fund of information; they are wide readers of bright ephemeral literature; they have tasted every fruit on the great tree of knowledge; they know a thousand interesting scraps; they are more versatile and ingenious and attractive than any other of the recent generations. But they are quickly led astray by sophistry, and easily led to surrender conviction when it conflicts with interest."

President Wilson, in an address at Washington University, said:

"A man who takes a course of four years of social life at some university has thrown away four years of that natural power to work which descended to him from his great progenitor, Adam. He now finds himself face to face with actual work in its true sense, and he also finds that he is not ready to work; his faculties are undeveloped, his fund of information is limited and very hazy; he is a college man, but he is not a trained man, nor an educated man. It is a singular fact that our universities are standing upside down, not on their heads—which might be not altogether a bad thing—but on the wrong end."

Listen now to Prof. Charles H. Grandgent of Harvard, who in his most interesting address as president of the Modern Language Association of America, entitled "The Dark Ages," expressed himself as follows:

"I suggest, indeed, that we alter the Century definition to something like this: 'The dark ages, an epoch in the world's history, beginning with or shortly after the French Revolution, marked by a general extension and cheapening of education resulting in a vast increase of self-confident ignorance. It was induced by the gradual triumph of democracy, and will last until the masses, now become arbiters of taste and science, shall have been raised to the level formerly occupied by the privileged classes.'

"It is pitiful to see the agonies that the ordinary college student has to suffer, if he is obliged to learn anything outright. It is amazing to see how readily he forgets the things which he is told and which, for the moment, he apparently understands."

President Foster of Reed College in Portland, Ore., said very recently, "It is possible to graduate from almost any college without an idea in one's head."

Judge Robert S. Lovett, lecturing recently at Yale, stated that only thirteen out of forty-six executive heads of railroads in this country are college graduates, and of forty-one accounting heads, thirty-five have never had a college dipolma.

Finally, President Nicholas Murray Butler of Columbia, in a recent report says, "It is little short of deplorable that there should be so much and so various evidence of the utter worthlessness, judged by lasting results, of a large part of the work done, or supposed to be done, in elementary school, in secondary school, and in college."

### Moral and Religious Training

If Professor Mead dislikes or disagrees with these opinions, let me assure him that he may not lay the flattering unction to his soul that they may apply to the schools of the East but do not apply to the schools of the Middle West. Nor will he be justified in assuming, however pleasant it may be to do so, that the engineering schools are exempt from the faults referred to, although I have urged for years the advantages of an engineering training as compared with a classical training.

Finally, let me say that it seems to me that one of the great faults in our entire educational system is that it puts the emphasis on the wrong place, namely, on the acquisition of knowledge, or intellectual culture. This I think is particularly true of our engineering education. Now purely intellectual culture does not touch the conscience, or affect the deeper springs of human action. It does not make a man a better father, a better husband, a better neighbor, or a better citizen. I am therefore glad that Professor Mead agrees with my last conclusion. We need more moral and religious training, more discipline from the cradle up in regard to our duties to others, and less intellectual culture in comparison.

# Small Sewage Pumping Station for Park Site

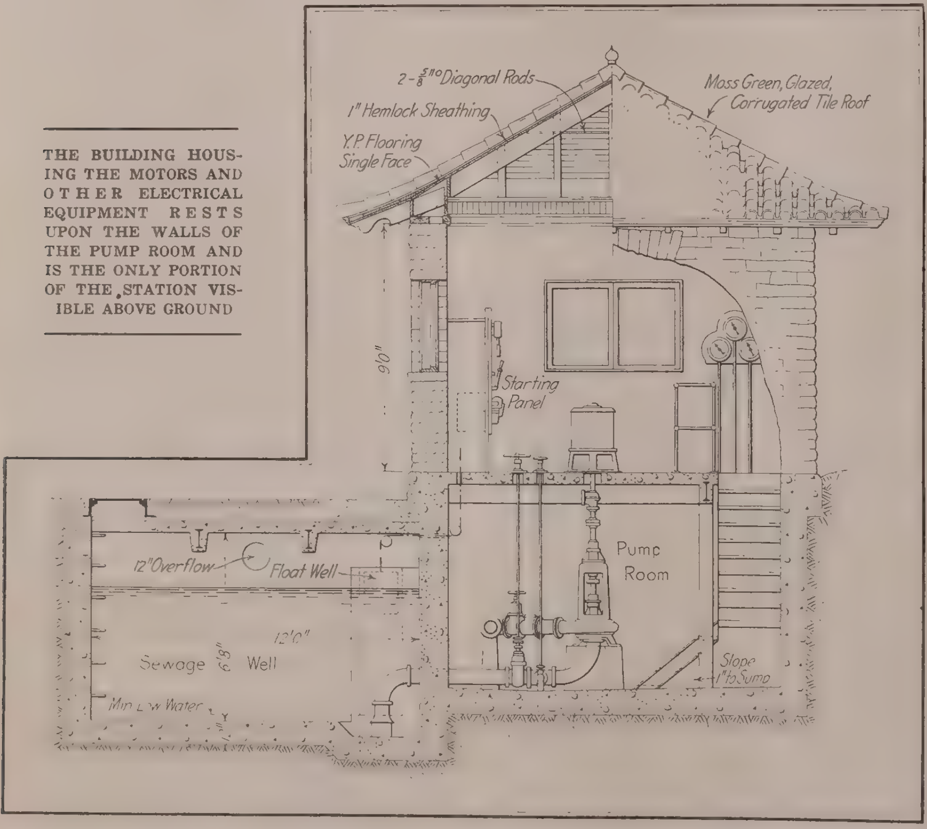
### Centrifugal Pumps, in Duplicate, Serve District of 2000 Population in West Chester, Pa. —Control Is Automatic

By W. DE WITT VOSBURY
Of Remington & Vosbury, Consulting Engineers, Camden, N. J.

LOCATED IN A PARK, THE STATION WAS DESIGNED FOR APPEARANCE AS WELL AS UTILITY

BECAUSE of its location in a public park the new sewage pumping station at West Chester, Pa., serving a district with a population of 2000, was designed to present an appearance which would not suggest its purpose. The walls, roof and floors of the well and pump chamber, where exposed, were washed with soda solution and rubbed to a smooth finish with a carborundum stone. The building was constructed of a local gray-blue stone, laid in broken courses, with flat stone arches spanning the door and window openings. The roof is covered with moss-green, glazed, corrugated tile. All exterior woodwork is painted white, while the interior woodwork is yellow pine with natural finish.

As shown by the accompanying illustrations the structure consists of a receiving well, adjoining which is the chamber containing the pumps, valves and piping. The building housing the motors and other electrical equipment rests upon the walls of the pump room and is the only portion of the station visible above the ground. The walls, roof and floors of the well and pump chamber were built of reinforced concrete, waterproofed. The stairway connecting the motor and pump rooms was also made of concrete, cast over a light structural frame.



THE BUILDING HOUSING THE MOTORS AND OTHER ELECTRICAL EQUIPMENT RESTS UPON THE WALLS OF THE PUMP ROOM AND IS THE ONLY PORTION OF THE STATION VISIBLE ABOVE GROUND

The sewage is screened before it enters the receiving well in a separate chamber located a few feet from the well. There are two sets of inclined bar screens so arranged as to be easily lowered or raised; the spacing of the bars is also adjustable. The screens are cleaned each day, and such solids as will not pass through are collected and deposited in a cesspool located alongside. The contents of the latter are removed at frequent intervals and taken to the disposal plant.

At the expected maximum rate of inflow the time required for filling the receiving well will be about 45 min. The storage capacity, which is only 5000 gal., was purposely made small in order that the sewage might leave the station and reach the disposal works while still fresh. The floor directly beneath the intakes to the pumps is depressed to form a shallow sump, thereby lowering the suction line to the floor level. This is desirable, as it permits of the removal of practically all of the sewage at each pumping and a large portion of the matter that has settled out and which, if allowed to remain, would eventually undergo septic action. The sediment which does collect is removed periodically by stirring while pumping is in progress.

### Pumping Equipment in Duplicate

The pumping equipment is in duplicate. Each unit consists of a 4-in. vertical centrifugal pump, direct connected to a 15-hp. single-phase, 60-cycle, 220-volt, repulsion induction motor, operating at a speed of 1200 r.p.m. The pumps are of the open impeller type and especially designed for sewage work. In order to reduce the length of the driving shaft each pump is mounted on a foundation 18 in. above the floor level. It should be noted, however, that, upon starting, the pumps are always under a suction head. For each unit there is a separate 6-in. suction pipe extending through the partition wall and terminating in a bell mouth, the bottom of which is level with the floor of the well and over the sump.

The discharge piping is arranged with separate gate and check valves for each pump, the layout of the whole being such as to occupy a minimum of floor space. There are also two small drainage sumps in the floor of the pump room, each connected by independent pipes to the suction lines of the adjacent pumps. The valves in these drain pipes, as well as the valves in the suction and discharge lines, have extension stems and, in case of accidental flooding, may be operated from the floor above.

Connection between the motor and pump shaft of each unit is made with a standard flexible coupling placed next to the motor. A thrust bearing at the top of the pump frame carries the weight of impeller and shaft. To reduce vibration each shaft has one adjustable guide or steady bearing, automatically lubricated with fluid oil. Whenever it is desired to remove the upper half of a pump casing for inspection a section of the driving shaft may be disconnected and withdrawn through the floor.

### Control Is Automatic

The automatic starting and stopping of each motor is controlled by a separate float switch, the pilot current from which actuates a self-starter. In addition to the latter there is mounted in duplicate on the starting panel an automatic circuit breaker having overload and no voltage release, with time limit attachment. There are also two pilot lights to indicate full line voltage and a four pole, double-throw switch. The starting panel is made of blue Vermont marble and all exposed brass and copper parts of the electric equipment are highly polished. Both the static and total discharge pressures are indicated in feet and pounds by three pressure gages mounted in the pump room. One gage is connected to the main discharge; the other two are between each pump and its respective check valve.

The maximum population of the district tributary to this station is estimated at 2800. It is doubtful, however, if the number will exceed 2000 during the life of the equipment, and this figure has, therefore, been used in all calculations.

Based upon the latter estimate and the known water consumption per capita in the districts already sewered the total 24-hour flow will be 130,000 gal., with a probable maximum rate of 128 gal. per minute.

Although pumps of smaller size would have been quite able to handle the flow, 4-in. pumps with a capacity of 400 gal. per minute were selected.

The feature determining the selection was the ability, owing to the larger openings in the impellers, to pass solids up to 1-in. in diameter without danger of clogging.

The sewage is pumped under a total head of 65 ft. through an 8-in. cast-iron force main, a distance of 1600 ft. At the rate of 400 gal. per minute the velocity is about 2.5 ft. per second, and the pipe is therefore self-cleansing. The specifications stipulated a pump efficiency of not less than 50 per cent and actual tests made after completion gave results slightly greater than this amount.

The contract for the work was awarded to the M. and T. E. Farrel Company of West Chester, at a price of $3,750 for the station and force main and $2,540 for the mechanical equipment. The latter was installed by Lewis, Robinson & Gant of Philadelphia, as sub-contractor. Remington & Vosbury of Camden, N. J. were the engineers.

# Build Crushed Stone Plant for Tunnel Muck

### Material from Chicago Waterworks Tunnel in Residence District Is Hauled by Motor Trucks to Specially Built Crushing Plant

THE question of disposing of the excavated material from the Wilson Avenue waterworks tunnel, which is being built in Chicago, was a serious one, particularly at the Shore shaft in a residence district built up almost solidly. After considerable effort the city, which is driving this 8-mile tunnel by day labor, as described in the Engineering Record of April 29, page 568, was finally able to make a contract with the Peoples Crushed Stone Company to take away the stone as fast as produced from the Shore shaft, to which all the muck from the 3-mile extension into the lake would come, and to remove the rock piled at the other shafts within a reasonable time after the completion of the work. The plant was described recently by H. L. Clausen before the Western Society of Engineers.

The contract, Mr. Clausen stated, provided that crushed stone for the lining of the tunnel should be furnished to the city upon requisition from time to time. The city was glad to be able to make this contract, inasmuch as it was relieved of a considerable expense in the removal of such a large quantity of excavated material, totaling more than 400,000 cu. yd. The company erected at Montrose Avenue and the north branch of the Chicago River a crushing and washing plant capable of handling between 750 to 1000 cu. yd. per day of 10 hours.

AVERAGE TIME TO LOAD AND UNLOAD TRUCK IS 15 MINUTES

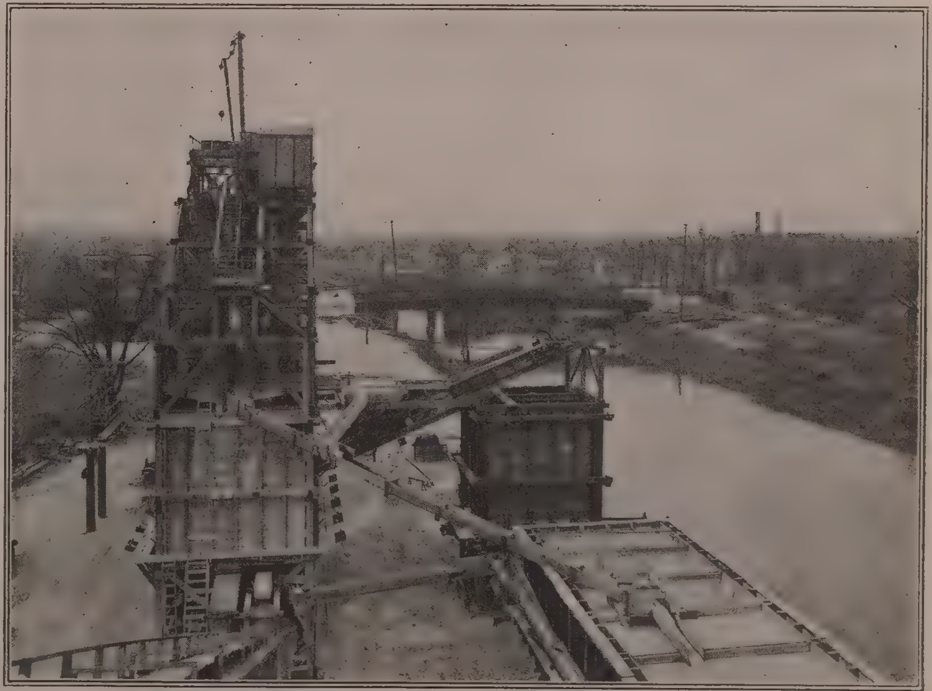
The plant consists of a No. 7½ gyratory crusher with concaves set to pass a 3½-in. product. From this crusher a No. 8 continuous-bucket elevator, having 85-ft. centers, elevates the crushed material to the top of the plant, at which point 500 gal. of water per minute is introduced by means of a centrifugal pump. The screening plant consists of two sets of conical screens located side by side four in a row, one slightly lower than the other. The first screens are perforated with 2½-in. holes, the second with 1½-in. holes, the third with ¾-in. holes and the fourth with 5/16-in. holes.

From these screens to 500-cu. yd. bins below the stone is stored ready for loading into trucks or wagons for the market. The oversize from the first screen passes through a No. 4 recrusher with concaves set for 1½-in. product. The tailings from this crusher are transported by means of a belt conveyor to the main or No. 8 conveyor and re-elevated to the screening plant. Under the bins a horizontal belt conveyor will transfer the product of any bin to an inclined conveyor at the rear for piling and storage purposes. The tailings from the 5/16-in. screen are carried to a settling bin consisting of a V-shaped trough, at the bottom of which two inclined 12-in. screw conveyors running at about 20 r.p.m. elevate the fine material into a storage bin, the water running down the screw by gravity into the settling basins below, from which the centrifugal pump furnishing all the water to the plant receives its supply. The stone crushed by this plant and the screenings are sold in the open market in competition with stone and gravel and torpedo sand.

Inasmuch as only one of the shafts, the Mayfair, is located on a railroad, all the excavated rock is removed from the various shafts by means of 7½-ton auto trucks having a capacity of 4 cu. yd. of mine run or 5 cu. yd. of the crushed material. The average time required to load and unload a truck is 15 min. and the speed on the road will average about 10 miles per hour or better.

The crushing plant cost about $50,000, and the standard price for the material at the bin is $1 per cubic yard, or $1.50 per cubic yard delivered within a radius of 3 miles of the plant.

Henry W. Clausen, engineer of waterworks construction, has immediate charge of the tunnel work. The design and construction of this project are under the direction of John Ericson, city engineer, and H. S. Baker, assistant city engineer.

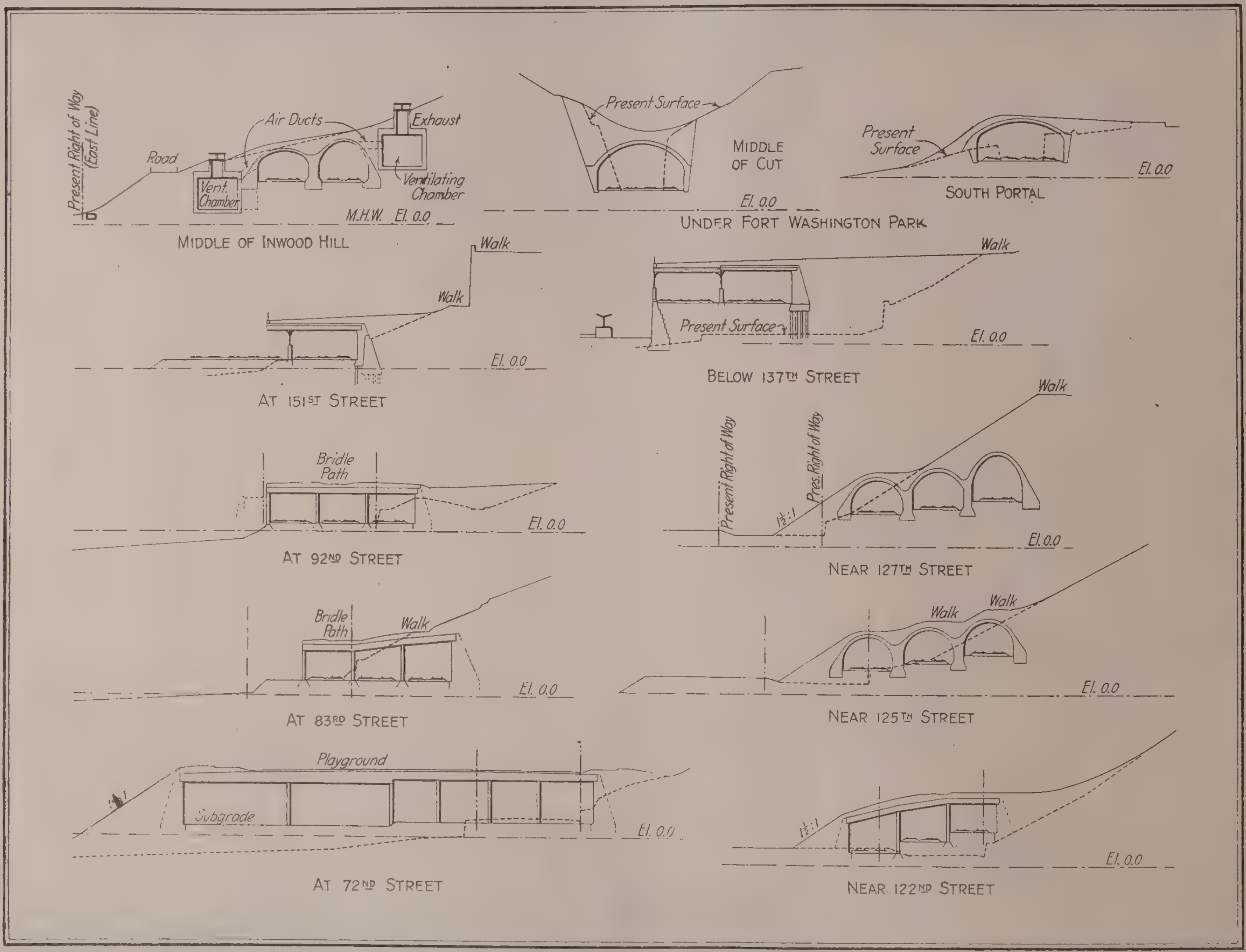


WASH WATER FROM TAILINGS TROUGH FLOWS TO SETTLING BASIN

# West Side Improvement Plans of New York Central Railroad in New York Filed

### Involve Relocation, Track Elevation, Yard Reconstruction, Covering of Tracks Through Parks and Electrification, at Cost of Upward of $50,000,000

WHAT IS DESTINED to become, next to the rapid-transit expansion under the dual contract, the biggest engineering work of the day in New York City seems likely of consummation now, after many years of negotiations. Plans are now on file with the Board of Estimate and Apportionment of New York City covering the main features of the so-called West Side improvement of the New York Central Railroad in that city. The first of a series of public hearings on the project, prior to the execution of the agreement by city and railroad, was scheduled to be held Monday of this week, but this article went to press before the outcome of that hearing was known. The main features of the improvement, which covers the railroad's 12-mile freight entrance to the city, and involves extensive relocation, track elevation, extra trackage, reconstruction of yards, the covering of the tracks through miles of parks, and the electrification of the entire line, have already been set forth in the news section of this journal. (See the issues of Jan. 22, page 126, and April 15, page 528.) The purpose of this article is to elaborate on some of the main features and present a few details.



THESE CROSS-SECTIONS CHOSEN FROM MANY SUGGEST THE VARIETY OF WAYS IN WHICH THE TRACK ROOF WILL BE ADJUSTED TO THE PARK SURROUNDINGS

## WEST SIDE LINE AT PRESENT

The West Side freight line, as the accompanying general plan indicates, leaves the main line at Spuyten Duyvil, across Spuyten Duyvil Creek from the extreme northern end of Manhattan. At this point the main line turns away from the Hudson River. The freight line crosses the creek and continues down the east bank of the Hudson to Sixtieth Street, where it swings over into Eleventh Avenue. It occupies Eleventh Avenue down to Thirty-third Street, and then swings over to Tenth Avenue. It then follows Tenth Avenue down to the junction with West Street, continues down West Street to Canal Street, turns east in Canal Street to Hudson Street, and south in Hudson Street, and terminates at the St. John's Park freight station at Beach and Hudson Streets, within a mile of the city hall. The entire line is operated by steam.

The line has two main tracks and numerous sidings. The main yard is between Seventy-second and Sixtieth Streets, where there are seven piers, four transfer bridges, a grain elevator, an engine terminal and various storage and switching tracks—none of them long enough for full trains. Between Thirty-seventh and Twenty-ninth Streets is another yard, or more properly a group of yards that have grown up more or less at random to meet local needs. They serve freight houses, a milk terminal, an express terminal, a market, four piers (with two intermediate piers not directly served), two transfer bridges, and various warehouses. There are limited switching facilities, necessitating operation across streets at grade. At St. John's Park, the end of the line, there is a freight house only, covering two city blocks. There are a freight house, milk station, team tracks and a small storage yard at Manhattanville, and a team yard at Inwood.

The line crosses Spuyten Duyvil Creek on a very low swing drawbridge. From here south to Sixtieth Street it is in the open on the water's edge most of the way. It passes through Fort Washington Park, a rugged point jutting into the river, in a deep rock cut. It crosses Dyckman (200th) and Manhattan (130th) Streets at grade, both of these streets being busy thoroughfares leading to ferries. It also crosses at grade 158th, Ninety-sixth and Seventy-ninth Streets, and eight streets in the vicinity of Manhattan Street. It runs along the full length of the foot of the slope of Riverside

Park, between the park and the river, and along the park extension north of 135th Street, and complaints of smoke and offensive odors from cattle trains have been rife. From Sixtieth Street south, where the line occupies city streets, operation is restricted to slow speed, with special boxed-in locomotives. In spite of this there have been numerous accidents, mainly to persons stealing rides, and the agitation to remove these tracks from the street has been the foundation of the entire improvement.

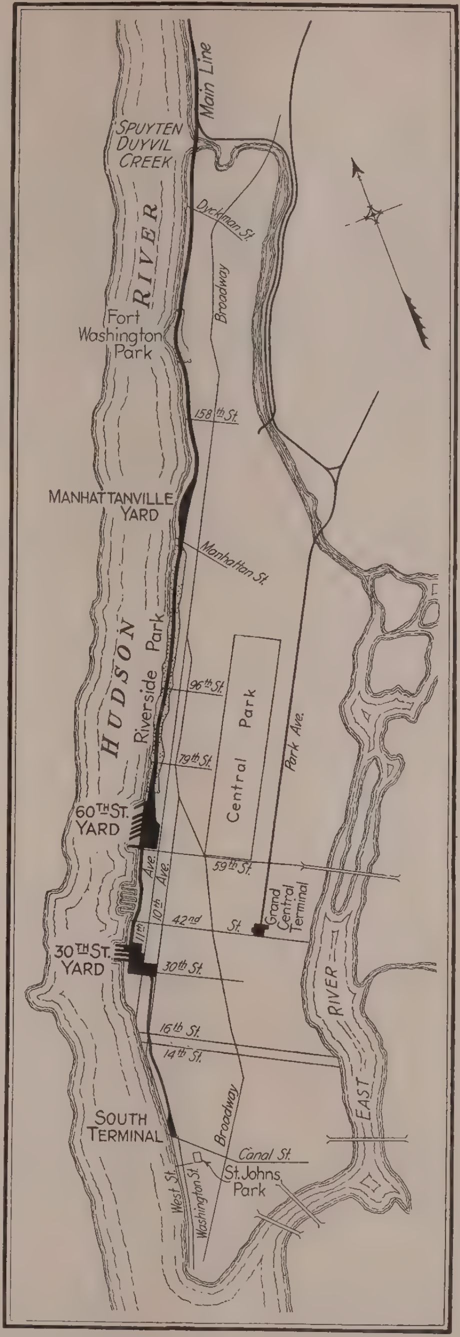
### SCOPE OF IMPROVEMENT

Comparing with the foregoing, when the whole project is completed there will be an electrified line with from two to six main tracks for the entire distance. Along the present city parks and the new one to be created north of Dyckman Street at Inwood, the tracks will be covered and much of the waterfront released to the city. All grade crossings will be eliminated. The tracks will be removed from Eleventh and Tenth Avenues and West Street, being replaced by an elevated system in Twelfth Avenue and the Marginal Way from Sixtieth to Thirtieth Street, and from there south on a private right-of-way. The yard and local freight facilities will be much improved.

The improvement will begin a mile north of Spuyten Duyvil, where the present six main-line tracks will begin to spread outward into the river. Of these the two outer tracks are the present freight tracks that continue down the west side. These will, in their new position farther out in the river, ascend on a filled approach on a 0.65-per cent grade to the new drawbridge, remaining as northbound and southbound tracks respectively. Between the two southbound passenger tracks a second southbound track will climb on a steel viaduct on a 0.65-per cent grade to the new drawbridge crossing over the most westerly passenger track at Spuyten Duyvil, and similarly a second northbound track will pass from the new drawbridge over three of the passenger tracks and come down on another viaduct between the two northbound passenger tracks. A typical cross-section of this arrangement is shown.

### NEW DRAWBRIDGE

The new four-track swing bridge will be about 20 ft. higher than, and from 65 to 120 ft. east of, the present bridge. It will be about 300 ft. longer than the present bridge, and will have two 100-ft. clear spans normal to the channel.



WEST SIDE LINE RUNS ALMOST FULL LENGTH OF MANHATTAN—HEAVY LINE SHOWN IS PROPOSED LOCATION

Where the new line strikes the hill south of Spuyten Duyvil Creek its center line will be about 136 ft. east of the present center line. From this point the four tracks will be laid in a cut-and-cover tunnel 2550 ft. long under Inwood Hill, under what is now private residence property, but will be taken over by the city for a park. In places the subgrade is above or barely under the present ground line, and it will be necessary to build up over the arches.

Emerging 500 ft. north of Dyckman Street just off the present right-of-way, the line will cross this street by a steel bridge on the site of the present crossing, and then the tracks will come down on a 0.65-per cent grade to the present tracks.

In this connection the filed plans show a tentative location and profile for future tunnel tracks to branch off on the river side 2500 ft. south of Dyckman Street, descend northward on a 1.03-per cent grade, and pass under Spuyten Duyvil Creek outside of the present drawbridge. The connection with the main line is not developed.

### COVERED CUT AT FORT WASHINGTON PARK

The present rock cut through Fort Washington Park will be widened to allow an additional track on each side, after which the four tracks will be arched over and filled above to conform as nearly as possible to the natural topography.

Below this park the main tracks will increase to six in number. A bridge and ramp will carry 158th Street over the tracks and down to the water's edge.

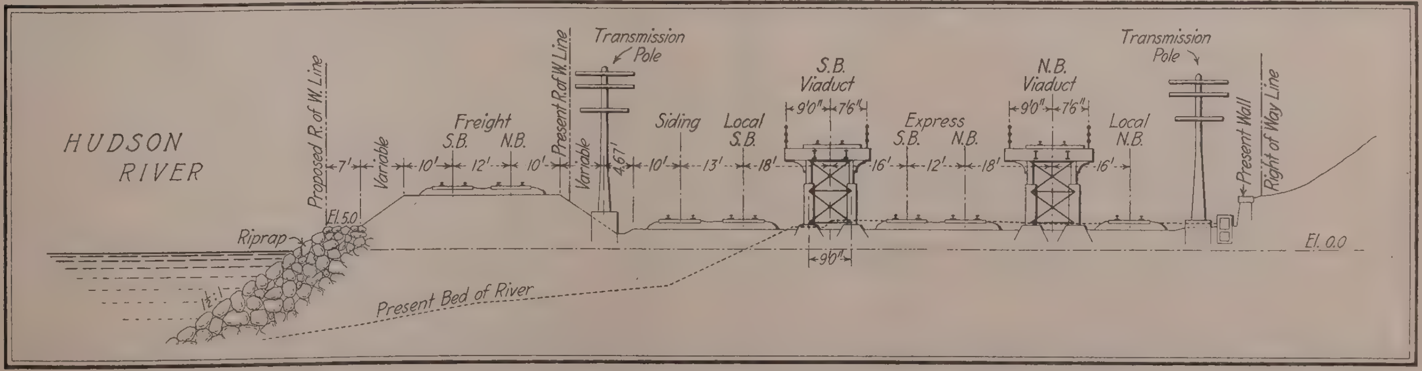
Beginning about 153rd Street two lead tracks will switch out on the river side for the uptown yard known as the Manhattanville yard, the tracks of which will begin to fan out at 145th Street, the yard terminating at 133rd Street. The layout will consist of a freight house, three milk tracks with platforms, six team tracks and a storage and switching yard for about 700 cars.

Beginning at 148th Street the six main tracks will begin an ascent on the established grade of 0.65 per cent to get over the streets in the Manhattanville valley. They will pass over the freight house and part of the yard, which will remain at the lower level.

This yard is alongside Riverside Drive and the extension to Riverside Park, and there has been much objection raised to it. The manner in which the main tracks will be covered and the objectionable features reduced will be set forth presently.

### TRACKS COVERED ALONG RIVERSIDE PARK

Crossing 133rd, 132nd, 131st, Manhattan and 129th Streets on bridges, the tracks being spread at this point for a future station, the line will encounter the original Riverside Park at the bluff surmounted by Grant's Tomb. From here to the south end of the park the tracks will be covered, now occupying practically the present right-of-way, now crowding in 50 or 100 ft. where the park slope is low and greater depth of



COMPLETE FLEXIBILITY OF OPERATION BETWEEN MAIN LINE AND FREIGHT TRACKS WITHOUT JUNCTION GRADE CROSSINGS NORTH OF SPUYTEN DUYVIL NECESSITATES THIS TYPICAL CROSS-SECTION cut is required to avoid an unseemly hump over the tracks. The entire trackage, including the throat of the new yard at the south end of the park, where there will be twenty tracks, will be covered, and the park will be graded over the roof to natural slopes beyond. Ninety-sixth and Seventy-ninth Streets will be carried over the tracks and down to the water's edge on ramps.

Of the large yard at Sixtieth Street, nothing will be retained except the elevator, piers and transfer bridges, and the piers will be extended to double their length. The south main-track outlet will be moved, of course, from Eleventh to Twelfth Avenue. The southeast corner of the yard, together with additional land to be required between Sixty-second and Sixty-ninth Streets, will be replaced by a local freight yard, with freight houses, team tracks and milk platforms. The many curved stub tracks will be replaced by straight through tracks with more switching leads. New tracks will occupy the site of the engine terminal, rendered useless by the electrification, and the approach to the yard will be extended north to Eighty-second Street. The new yard will accommodate 80-car trains in halves, and will have a total capacity of about 2700 cars.

It is at this point that the new location will begin. The main tracks will have ascended through the yard, and at Fifty-ninth Street they will enter Twelfth Avenue and the Marginal Way on an elevated structure. They will have been reduced in number to four, but alongside them on the river side space will be reserved for extension of the viaduct and the laying of two municipal tracks, unrestricted as to use, as provided in the agreement. Between Fifty-second and Forty-first Streets the tracks will swing to the east to clear the inshore extensions for the 1000-ft. piers at and above Forty-sixth Street, one of which is now under construction.

### Two-Level Yard at Thirtieth Street

Between Thirty-seventh and Thirtieth Streets will be the reconstructed Thirtieth Street yard, which will have nothing in common with the present yard except the land occupied and four lead tracks on pier 76. The new yard will be a double-decked terminal, with tracks, freight houses, warehouses, express terminal, milk station and team driveways systematically arranged on both levels, and with connections between the two levels. It will occupy ten city blocks.

From this point south there will be only two main tracks. These will swing around the yard into Thirtieth Street on a 23-deg. curve, the tentative municipal tracks continuing down the Marginal Way. The two New York Central tracks will turn off Thirtieth Street into a private right-of-way just far enough west of Tenth Avenue to avoid the properties fronting on the avenue. At Sixteenth Street it will cross to a similar position east of the avenue, at Gansevoort Street it will take a location just west of Washington Street, and it will finally end at a new terminal bounded by Canal, West, Houston and Washington Streets. In all of this section on private right-of-way alignment will be sacrificed to a considerable degree to bring the line on the most feasible right-of-way.

### Park Treatment an Important Feature

A very material part of the improvement will be the park treatment, embracing the covering of the tracks through the parks, and the grading and landscape treatment over the covering to conform with the surroundings. The work to be done along these lines in Riverside Park alone is estimated at upward of $10,000,000, and an additional $4,000,000 is expected to be spent on similar work at other points. The roof over the tracks will vary from a shallow structural steel construction with a few feet of earth on top, where there are numerous tracks and little available depth, to arches of various rises where feasible. In general the main tracks will be paired, with the roof supports between pairs, and to facilitate the park treatment along the slopes the pairs of tracks will at many points be on different levels.

A number of typical cross-sections are shown. As the sections show, the roof along Riverside Park will in many cases be sloping wholly or in part. At the extreme south end, where in return for additional easement secured by the railroad for the remodeled Sixtieth Street yard, the railroad will roof over a considerable area and make it part of the park, the problem of lack of available depth has been solved by the laying out of a playground on the broad flat roof, with only a 6-in. earth covering and a gentle slope for drainage. At the bluff at Grant's Tomb arches are feasible, and to help preserve the steep slope there will be a different profile for each pair of tracks.

### At Manhattanville

Along Manhattanville there will be a different sort of treatment. Because of the yard at the water's edge it is not feasible to carry the park across and slope it down to the river. The height of the park slope and difference in elevation between the main tracks and the yard, however, make it possible to carry the park out over some of the tracks in a high-level area overlooking the river and ending at a parapet. The roof over the tracks will begin at 135th Streeet and extend north to 152nd Street. As the sections show, the roof will be a flat one of structural steel. This may be covered with a thin layer of earth, built up back to the bluff. At the south end, where the main tracks are much higher than the yard, all six will be spanned, and the park at the parapet will be about 45 ft. above the yard. At the north end fewer tracks will be spanned and part of the structure will be cantilevered. The railroad will build the steel roof only at this point, leaving the city to do the grading.

The deep rock cut at Fort Washington Park will be arched over and fill placed over the arch, as shown in the two cross-sections, for 1300 ft. The treatment of Inwood Hill will be similar in a general way to that above Grant's Tomb in Riverside Park. Arches will be used except at the south portal, where there will be a short stretch of flat roof with a parapet at the outer edge.

The Inwood Hill section presented here shows two ventilating chambers. These are a feature of the Inwood tunnel and of that along Riverside Park. The one pair of chambers at the middle of the half-mile Inwood tunnel will serve it. For the three-mile tunnel under Riverside Park there will be eight ventilating exhausts and five inlets. The open face on the river side of the construction along Manhattanville yard will provide the ventilation at this point, and the tunnel through Fort Washington Park is not long enough to need any provision for this.

As pointed out in the note in the Engineering Record of April 15, the figure of $50,000,000 commonly mentioned as the cost of the work is virtually the minimum figure to provide what may be called the necessities. The engineers who have been in touch with the problem for years realize that by the end of the six years set for the completion of the improvement the additional features likely to be incorporated will probably double or treble the cost.

The plans have been developed through the collaboration of the engineering department of the New York Central Railroad and a board of consulting engineers acting for the port and terminal committee of the city's Board of Estimate and Apportionment. The members of the committee were Ernest P. Goodrich (recently resigned), consulting engineer to the borough president of Manhattan; C. W. Staniford, chief engineer of the Department of Docks and Ferries, and John F. Sullivan, consulting engineer of the Bureau of Contract Supervision. For the railroad, G. A. Harwood, chief engineer of electric zone improvements, was in general charge, and the plans were prepared in the office of and under the immediate supervision of H. D. Jouett, designing engineer of West Side improvements.

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# Warehouse Crane Runways Carried on Wall Brackets

**New Orleans Cotton Buildings Designed with Reinforced-Concrete Walls to Resist Heavy Lateral Pressure and Carry Crane Loads**

ONE of the features in the reinforced-concrete warehouses now under construction in the port improvement at New Orleans is the design of the walls between the various one-story building units. As described in the Engineering Record of March 27, 1915, page 402, six large cotton warehouses, covering an area of about 50 acres, are being built upon creosoted timber piles and are divided into compartments, generally about 32 x 100 ft. in plan, by reinforced-concrete fire walls. In addition to a description of the design of these walls, which contain brackets for carrying the crane girder rails, various special details will be illustrated.

The warehouses, which are so designed that they can be extended in the future, if desired, are in two symmetrical rows of four buildings each. The two through cotton warehouses are each 676 x 173 ft., 45 ft. high, and the two large f.o.b. and consigned cotton warehouses are each 676 x 273 ft. and 35 ft. high. Fire walls in each are 12 in. thick, spaced 32 ft. on centers, and detailed as shown in the accompanying typical section.

Expansion joints are provided at the middle of the larger buildings, and detailed with special care to insure weather-tight joints. In the smaller buildings the expansion joints are located off center, but are directly opposite those in the larger buildings. This was necessary in order that the crane runways could be extended through from one building to another. The flashing used and the methods of attaching it are shown in the large-scale drawings herewith, showing both face-wall and dividing-wall joints.

### Fire Wall Design

The walls are designed to resist the vertical loads from the roof and cranes and the

NEW ORLEANS COTTON WAREHOUSES OF REINFORCED-CONCRETE—NOTE REINFORCING STEEL FOR WALLS ON LEFT

bending stresses caused by the eccentricity of the crane loads and by the horizontal pressure of the piles of cotton. Cotton was assumed to weigh 20 lb. per cubic foot, and, where piled against a wall, to exert a horizontal pressure equal to one-sixth of the vertical pressure. Cotton in the through warehouse was assumed to be piled 30 ft. high.

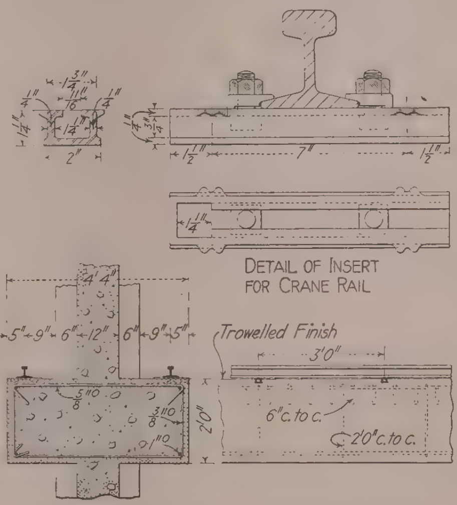
In addition to resisting the above loads, the walls and pilasters have sufficient reserve strength below the elastic limit of the reinforcement to resist a horizontal pressure of 200 lb. per square foot which might be exerted by the top two layers of cotton (4 ft.) becoming saturated and swelling. This saturation might occur in case of a fire and consequent opening of the sprinkler heads.

The working stresses used are those recommended by the Joint Committee for 1:2:4 concrete. For the case of combined direct stress and bending, the total stress allowable was kept the same as for axial compression.

### CRANE RUNWAY BRACKETS

The crane loading on each rail consists of two wheels spaced 9 ft. 7½ in. on centers, with a maximum load of 10,250 lb. each. The wheel supports are designed as a continuous shelf or bracket, carried by the walls without beam action. The details of the reinforcement used are shown in the drawing herewith. The rails are supported and held in place by the malleable iron inserts shown, spaced 3 ft. on centers, and so designed that the bolts and clips holding the rails are easily inserted and adjusted.

In designing the brackets, the concentrated crane loads were assumed to be uniformly distributed over a horizontal distance of 2 ft., the depth of the bracket. The ⅝-in. rods on 6-in. centers at the top of the bracket provide for the tension and aid in the distribution of unsymmetrical loads to the walls as eccentric loading. In computing the bending stress in the walls, the concentrated crane loads were assumed to be distributed along the wall between lines on a 2:1 slope, spreading over greater length as the distance below the load increased.

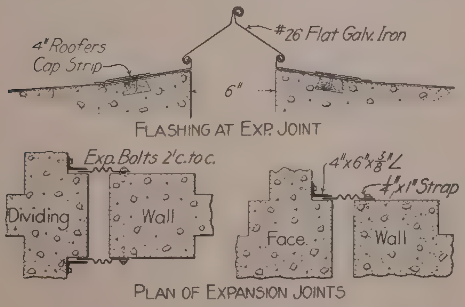


CONCRETE BRACKETS CARRY CRANE RAIL

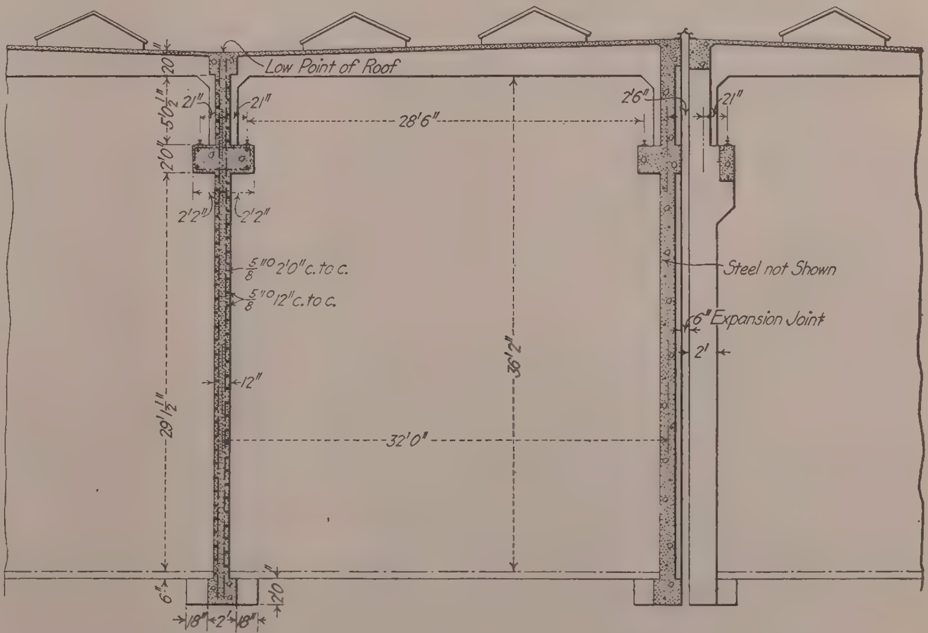
The warehouses were designed for the Board of Commissioners of the Port of New Orleans by the consulting engineers, Ford, Bacon & Davis, of New York, New Orleans and San Francisco, who are supervising the construction being carried out by the Jefferson Construction Company of New Orleans, La.

## World's Largest Oil Well

Under a pressure of 1035 lb. per square inch and flowing at a rate of 260,000 bbl. a day, a well, known as Cerro Azul No. 4, near Tampico, Mexico, and said to be the greatest oil well in the world, was recently brought in by the Mexican Petroleum Company, Ltd. The well casing had been tested to a pressure of 1050 lb., which was practically equaled by the pressure registered after the well was closed. The force of the escaping gas under this pressure blew the 2-ton drill bit out with it and threw it 125 ft. from the well. Its cable became entangled with the valve at the top of the casing and tore the latter off. The drill bit and the escaping oil, which subsequently rose to a measured height of 600 ft., demolished the derrick. It is estimated that 1,000,000 bbl. escaped before the flow was shut off by sliding an extra valve over the casing in a tongue-and-groove track clamped to the head of the well. More than half of this oil was saved in temporary reservoirs, and the rest of it was burned after it had run some distance from the well and before it left the company's property.



DETAILS OF EXPANSION JOINTS



TYPICAL PART SECTION OF BUILDINGS SHOWS REINFORCEMENT OF FIRE WALLS

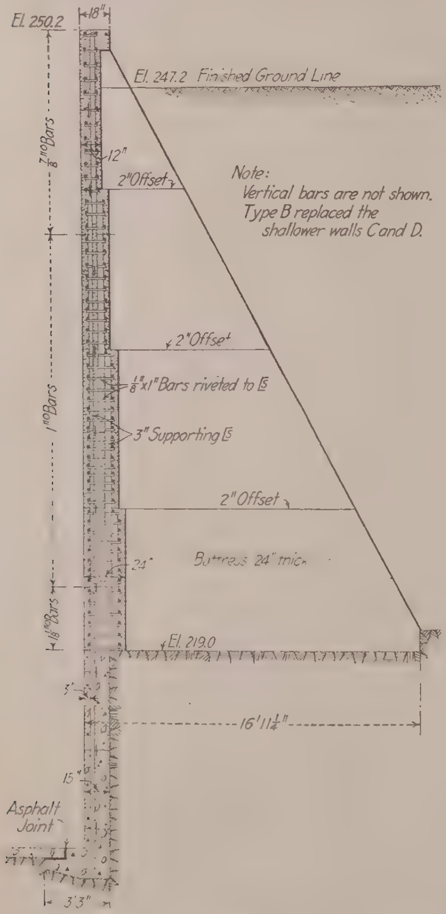
# Huge Circular Reservoir in Dubuque Protects Congested-Value Business District

### A Study of Alternate Sites Led to an $80,000 Saving— Thin Buttressed Walls 41 Feet High Found Most Efficient

By DABNEY H. MAURY
Consulting Engineer, Chicago

THE selection of a reservoir site near the congested-value district, thereby saving a city of 40,000 people $80,000, circular wall design in which the hoop principle was not utilized, and innovations in the inlet, outlet, and overflow, are features of the reinforced-concrete reservoir, 180 ft. in diameter and 41 ft. deep, at Dubuque, Iowa, completed last year. The larger and older portions of the city, including its business district, are built on the comparatively low land between the bluffs and the Mississippi River. The newer residential districts cover the bluff to the west at elevations of from 140 to more than 300 ft. above low-water mark.

The city takes most of its water supply from wells in sand and gravel in the low ground near the river and close to the main pumping station, which is located in the extreme northern end of the city opposite Eagle Point, where the bluffs jut out boldly close to the shore. The water from the wells is pumped into the surface storage reservoir of 650,000-gal. capacity, from which it is repumped into the distribution system. The latter is divided into two services, high and low, and until recently the low-service pressures were limited by the level of water in what is known as the Level Reservoir, with flow line at El. 136. This reservoir has a capacity of 1,000,000 gal., and was built a number of years ago to impound a small supply of water from old mine workings. From 200,000 to 400,000 gal. of water per day are still collected from these old workings. The high-service pumps, which are electrically driven, take their supply from this reservoir, which is also fed by the low-service mains, and deliver it into the high-service mains. A standpipe having a capacity of 440,000 gal. and a flow line at El. 397 is connected to the high-service distribution system.



TYPE B WALL AND BUTTRESS—HORIZONTAL STEEL CARRIES ALL STRESSES TO ROCK THROUGH BUTTRESS

Several years ago the Board of Waterworks Trustees selected a site for an elevated reservoir of a capacity of 7,500,000 gal. in a city park on top of the bluffs at Eagle Point, opposite the main pumping station. A topographic map of the proposed reservoir site had been prepared and test pits had been sunk through the top soil to bed rock, when the writer was called in, late in 1913, to pass upon the preliminary plans and estimates and upon the suitability of the topography and soil conditions for a reservoir of the capacity contemplated.

## Value of Reservoir Site Near Congested-Value District

It was at once apparent that the location of the reservoir with regard to the distribution system and with regard to the congested-value district, which was comparatively small in area and nearly 3 miles south of the pumping station, was far from being a desirable one. It was explained to the board that if all the water required at times of fire, or of other excessive demand, had to traverse the long lines of mains leading southerly from the pumping station, the friction loss would be very much greater than if there were another source of supply, such as a large reservoir, near the place of maximum demand.

To illustrate this point computations were made on the assumption that the rate of domestic consumption during sprinkling hours on a hot day would be 3500 gal. per minute, which quantity of water would be distributed throught the city; and that, in addition, 4000 gal. per minute would be required to meet the demands of a fire near the center of the congested-value district.

These computations showed that with the reservoir located opposite the pumping station, the total friction losses in the mains alone, not including hydrant branches nor hydrants, would be more than 41 lb.; whereas with the reservoir located on the bluffs to the west of the center of the congested-value district the corresponding friction losses would be only about 3 lb. The computations further showed that under the assumed conditions of demand it would cost more than $200,000 to reduce these friction losses to 3 lb. by putting in additional mains. The expenditure of so large a sum would, of course, be out of proportion to the benefits derived and if the results had to be obtained by installing additional mains, it would be more economical to spend less money and put up with somewhat greater friction losses. It would not be economical, however, to make the additional main smaller than 20 in. in diameter, and the cost of even a 20-in. main would be more than $80,000. This latter sum was accordingly considered the lowest possible estimate of the advantage possessed by a reservoir site opposite the congested-value district, over the one which had originally been chosen.

ERECTING STEEL DAMS AND BAR SUPPORTS

The proposed location was therefore abandoned and another reservoir site secured on the high ground on the bluffs, opposite the center of the congested-value district on the south side of Third Street between Burch and Summit Streets.

## Rock Topography Determined

Five test pits and sixteen test borings were made to determine the underlying rock topography. The ground sloped each way from a ridge which crossed the north end of the lot from northwest to southeast, and the rock surface conformed roughly to that of the overlying earth, which is a reddish-yellow clay, fairly homogeneous in character. The rock is a limestone containing occasional pockets or nodules of various minerals, most often of galena or of some of the zinc ores, although pyrites of iron or copper are not uncommon. Some of these ores were said to carry small percentages of silver. These limestone formations are those which, fifty or seventy-five years ago, were somewhat extensively mined at Dubuque, as well as in the vicinity of Galena, Ill. Many evidences of old workings are still to be seen in the neighborhood of the reservoir site. The most notable characteristic of the rock is its exceptionally well-defined horizontal stratification.

## Considerations Governing Design

It was naturally desirable that the reservoir should be as large as might be economically possible, and a capacity of 7,500,000 gal. was finally decided upon. This provides a storage of nearly three days' supply at present rates of consumption.

THE DUBUQUE RESERVOIR HOLDS 7,500,000 GALLONS CLOSE TO POINT OF CONSUMPTION

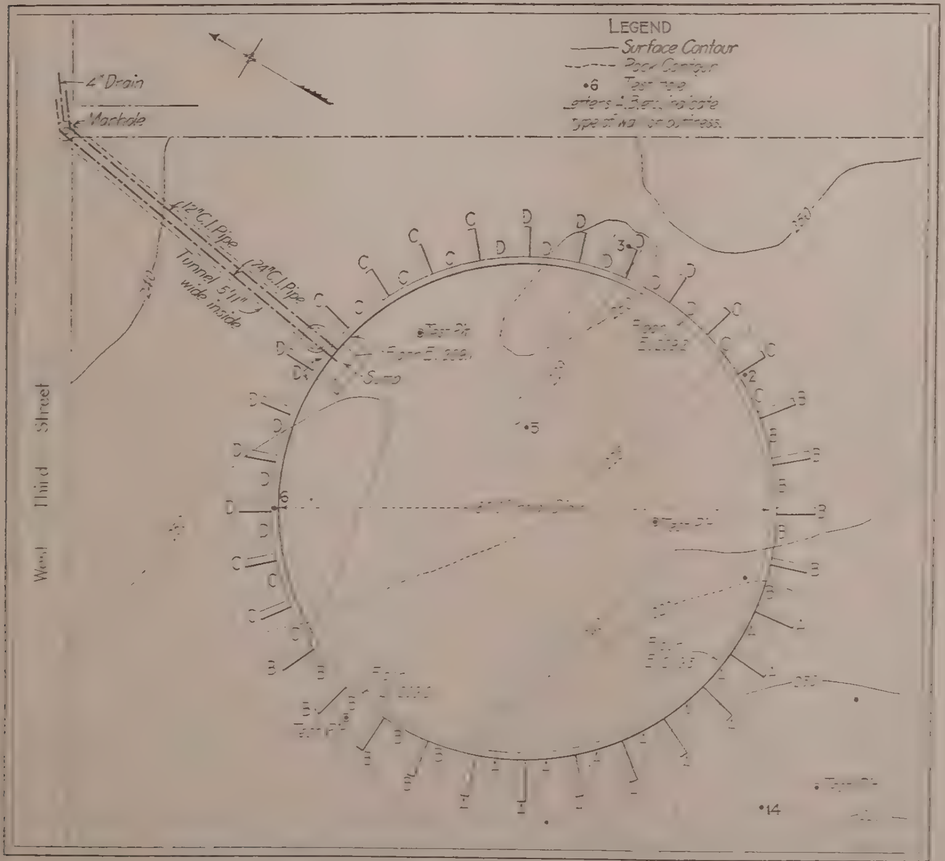
The pressure at which water had formerly been pumped to the low-service territory was much below that at which the pumping engines could safely be operated. To increase this pressure would give greatly improved fire and domestic service to all points within the low-service district, would enable a large part of the high-service district to be transferred to low service, thus saving the cost of pumping water a second time to the area so transferred, and would cause the main steam pumps to operate at more nearly their full load and, therefore, with greater economy. Consideration of these facts and of the elevations of the surface of the ground at the site selected led to the conclusion that the flow line of the reservoir should be not far from El. 250, Dubuque city datum. This elevation requires a discharge pressure of about 110 lb. on the main steam pumping engines and gives static pressures of from 90 to 105 lb. at the hydrants in the congested-value districts.

The most suitable ground on the site purchased was that nearest to its northern end, fronting on Third Street. It was found that a circular reservoir would fit the topography of the lot better than a rectangular reservoir, in addition to leaving room in the northeast corner for an imposing approach to the reservoir, and in the northwest corner for a new high-service pumping station to be built later. The circular form also required the minimum length of wall for any given depth and capacity, and involved the smallest possible danger of cracks resulting from expansion and contraction of the wall.

The fact that the various strata of rock were absolutely separated from each other by horizontal joints determined the shape of the reservoir bottom, which was made level with only enough slope on the upper surface of its concrete lining to give the necessary drainage toward the outlet pipe.

The selection of the best type of wall was not, however, so easy, and the final decision was not reached until computations and estimates had been made on a score of different wall sections. It was promptly decided that in the design of the wall no credit should be given for earth pressures acting against its outer surface. The lower portion of the wall would be built solidly against the sides of the excavation in the rock, and it was reasoned that in spite of the fact that the rest of the wall would be surrounded by earth almost up to its top, it would not be safe to count on any help from the external pressures of this earth resisting the internal water pressures, because of the fact that at times of dry, cold weather there would be a tendency for the clay outside of the wall to contract and to shrink away from the wall, with the result that the water pressures in the reservoir might set up disastrous stresses in the wall before the wall could stretch sufficiently to come into bearing against the clay. The design of the wall was therefore made just as strong as though there were no earth outside of it.

The question of whether or not the reservoir should be covered was given much thought. It was estimated that a covered reservoir would cost about $17,000 more than an open reservoir. The temperature of the water as it leaves the surface condensers is probably never below 55 deg. Fahr., so that there could be no serious trouble from ice, even if the reservoir had no roof. As it was planned to inclose the entire structure by a strong ornamental fence, built a sufficient distance from the wall to prevent pollution of the water by visitors, and as the elevation of the wall above the ground would reduce the risk of contamination by dust or the like, it was believed that the danger of the water becoming polluted in an open reservoir would, under anything but the most careless management, be so small as to be negligible. The roof would prevent the growth of algæ in the water, but as these growths are harmless from a sanitary viewpoint, and as they can be cheaply prevented by other means, it did not seem that the heavy expense of covering the reservoir would be justified.



THE DUBUQUE RESERVOIR HAS BENT SLAB WALLS BETWEEN SUPPORTING BUTTRESSES

### CIRCULAR BUTTRESSED WALL VS. HOOPED WALL

A gravity wall seemed to involve prohibitive expense. Computations of the steel required for a reinforced-concrete wall in which the steel should resist the water pressures in the same manner as do the hoops of a barrel, showed not only that the amount of steel would be excessive, but also that this type of wall would not be an economical one for this location, because it would not permit advantage to be taken of the elevation of the higher portions of the rock; that is to say, the steel reinforcement in those parts of the reservoir where the rock was highest would have to be just as heavy and be carried down just as far in order to give continuity to the bars, as would be the case if the surface of the rock were level and were all as low as its lowest point.

Various types of sloping walls, or of walls a part of which was vertical and a part built on a slope, were also considered, but here again the desirability of taking advantage of the elevation of the higher portion of the rock, the undesirability of having any portion of the structure resting upon rock while another portion was supported by the earth, and the fact that the width of the lot left no room to spare, combined to eliminate all types of wall of which any part would be built on a slope.

The wall finally selected was one which availed itself to the fullest possible extent of the inequalities of the rock surface, being thin and practically without horizontal reinforcement wherever it was built against the solid rock. All of the stresses in the wall above the rock were transmitted to the solid rock by means of buttresses, the height of these buttresses being adjusted to the actual elevation of the rock surface. The wall between the buttresses was reinforced as a slab continuous over its supports. This permitted the horizontal reinforcing bars near the outer edge of the wall to be laid to a circle around the reservoir with proper provisions for laps at convenient points. Negative moment bars were also inserted near the inner surface of the wall opposite each buttress.

The general design of wall and buttresses was such as would simplify the construction of forms and reduce their cost. The lower portions of the buttresses were poured without other form than the earth excavation, while the wall forms were used over and over again as the wall was carried up.

As originally planned, there were four typical sections of wall and four typical sizes of buttress, depending on the elevation of the rock. After the overlying soil had been removed from the rock surface, however, it was found that in a number of instances float rock had been struck by the test borings, and that the solid rock actually lay deeper than these borings had indicated. In order to carry all buttresses down to the solid rock it was therefore necessary to eliminate the two shallower types.

The accompanying drawing shows in cross-section the type B wall and, in vertical elevation, the type B buttress. The vertical reinforcing bars in the type B wall were of various lengths and were placed near the inner face of this wall, extending from the bottom upwards. They served as anchors for the wall and contributed to the economy of the design, for without them the buttresses would have had to be larger and more numerous to resist the overturning moments due to the internal water pressures.

The specifications prohibited the use of chutes for conveying the concrete unless the concrete should be thoroughly remixed just before it reached its place in the work. In order to give an opportunity for proper spading and tamping in the forms it was specified that the wall should be built in sections only 4 ft. deep. To minimize the danger of leakage at the joints between sections, ⅛ x 8-in. steel dams were provided, extending continuously around the wall. They were bolted to the vertical steel channels and facilitated the erection of these channels by spacing them properly and holding them firmly in their places until the reinforcing bars could be fastened to them.

### Overflow Submerged Below Wave Agitation

Experience with the Sioux City reservoirs, and with other reservoirs located on wind-swept hills, had shown that a hard gale would produce in a reservoir of this size waves of surprising height. In order to prevent the overflowing of large quantities of water in stormy weather when the reservoir was nearly full, the 12-in. overflow pipe, instead of terminating with an open end 1 ft. below the top of the wall, was fitted with two elbows so as to form a return bend, the lower end of which was carried down 13½ ft. below the top of the wall, or 12½ ft. below the flow line, at which depth there could be very little agitation of the water. To prevent water from being siphoned out of the reservoir the plans called for holes to be drilled in the top of each elbow so that the vacuum would be broken at these points and siphon action could not take place.

### Provision for Circulation

Water enters and leaves the reservoir through the same 24-in. cast-iron pipe, which is bolted to the branch of a flanged tee set in the sump just inside the reservoir wall. A check valve on one end of the run of this tee opens into the reservoir and a check valve on the other end opens out of the reservoir. Incoming water is thus projected around the reservoir in a clockwise direction, tending to produce about as much stirring action as could be obtained without baffles or other artificial means. The water in the center does not, of course, receive as much agitation from the incoming stream as that nearer to the circumference, but whenever water is flowing out of the reservoir the stream lines run from all parts of the water toward the outlet check valve. It is believed that with the frequent alterations of filling and discharging this arrangement of the check valves should in the long run give adequate circulation at the minimum of cost.

### Bids Received

The contract included, in addition to the construction of the reservoir and appurtenances, the laying of 2150 ft. of 24-in. cast-iron main to connect with the 20-in. main crossing Third Street at the alley between Main and Locust Streets. All cast-iron pipe, specials and fittings, and all gate valves and check valves were to be furnished by the city, the contractor to furnish everything else.

The estimated quantities were as follows: Earth, 22,100 cu. yd.; rock, 2200 cu. yd.; steel, 97 tons. The ten bids received ranged all the way from $62,000 to $106,790. The two lowest bids were rejected because of vital informalities, and the contract was awarded on Aug. 11, 1914, to the Mid-West Construction Company of Kansas City, Mo., on its bid of $66,000. The writer's estimate of the cost of the work, not including the cost of lands, the cost of putting in a 20-in. tee and three 20-in. gate valves to connect the reservoir branch to the distribution system, nor the cost of fencing the reservoir and turfing the lot, was $87,340. As nearly as can be ascertained at this writing, the total cost of the work covered by the above estimate, including all extras, engineering, inspections, tests and other expenses, was less than $82,000, or more than $5,000 below the original estimate.

### Injunction Delays Work

Work was begun on Aug. 13, 1914. It was stopped on account of weather by order of the resident engineer for eight days at different times during the fall and winter. The work was further greatly delayed after Oct. 2 by restricting the use of the steam shovel from 7 a. m. to 10 p. m. as the result of an injunction obtained by a neighboring property holder, who complained that the noise of the steam shovel constituted a nuisance. It had been the intention of the contractor to work day and night, so as to have this wall built before freezing weather came, in the hope that he might thus avoid delay and danger from the caving of the earth during the spring thaws. The injunction prevented this and by throwing the work into bad weather so delayed it that the construction operations must unquestionably have proved far more of a nuisance to the neighbors in the long run than if the contractor had been allowed to proceed without interruption.

The stripping was done with slip scrapers. Wheel scrapers then moved some 1500 cu. yd., and as the excavation grew deeper a steam shovel was put to work loading the earth on small cars which were hauled up a narrow-gage incline track. Practically all of the rock after it had been broken by blasting was also handled by the steam shovel. Other difficulties encountered by the contractor resulted from the caving of the earth bank on several occasions and from the fact that the rock proved to be much harder and more difficult to deal with than he had anticipated.

### Test Wall Leakage

After the forms were removed the reservoir was filled. A test made to determine the total amount of leakage showed that in 7½ hours the water level fell ⅝ in., corresponding to a rate of loss of 32,000 gal. in 24 hours, a small portion of this loss being due, of course, to evaporation.

The reservoir was drained and, with the space between the outer surface of the wall and the surrounding earth filled with water, quite a number of wet spots showed on the inner surface of the wall, and there were also three or four places in which very small streams spurted out. One of these places was at the lowest construction joint, the surface of which had been covered with clay from the caving bank. This leak was doubtless due to the fact that the contractor had not succeeded in removing all of the clay before pouring the next lot of concrete. There were practically no other leaks at the 4-ft. construction joints, the remaining leaks or damp spots occurring where stone showed on the inner face of the wall, indicating that at these points the spading had not been as efficient as it should have been. These rough spots were less in number than is usually the case in work of such magnitude, and the quality of the concrete work generally was well above the average.

All of the spots where there was any indication of leakage, however small, were marked, and the contractor promptly set about filling the spots with a mixture of pulverized iron and cement. This was successfully done, and it is believed that the reservoir is now as nearly absolutely watertight as it is possible to make such a structure.

Ralph P. Melendy, then engineer for the water department, was resident engineer in charge of the construction work. Under his supervision the Mid-West Construction Company fulfilled its contract obligations in a very creditable manner.

Materials for the reservoir were inspected and tested by Robert W. Hunt & Company.

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## Texas Conducts Sanitary Campaign

As a result of the agitation for incinerators waged by the state sanitary engineering department of Texas, records show that during the past six months approximately $250,000 has been expended for incinerators by 26 Texas towns.

# Letters to the Editor

*Comment on matters of interest to engineers and contractors will be welcomed*

## Justice to the Contractor

SIR:—With reference to the editorial on page 502 of the Engineering Record for April 15 concerning the usual custom of making a chief engineer sole judge of his own specifications, it seems that if the engineer is an honest one, no contractor could find fault with this clause in the specifications. Before a man has reached the position of chief engineer he has come in contact with a great many contractors who have become acquainted with his methods. These contractors, consequently, will make a high bid if they are dealing with an engineer who is inclined to be unfair, and a correspondingly low bid to the engineer whose decisions are fair. Clients soon find this out. Thus the engineer who will not deal fairly will be eliminated finally.

A. O. CUNNINGHAM,
Chief Engineer, the Wabash Railroad.
St. Louis, Mo.

[The process of elimination referred to by Mr. Cunningham is undoubtedly going on to some extent, but it alone should not be relied on to correct the abuses referred to in the editorial mentioned. It seems to the Engineering Record that a process of education, which would teach engineers, contractors and clients alike how to draw and administer contracts to secure a higher grade of results, would be distinctly preferable.—EDITOR.]

SIR:—I heartily agree with the editorial found on page 502 of the Engineering Record of April 15, and am willing to support a movement to place engineering and contracting on the highest planes possible. I have said that such clauses as "in the judgment of the engineer," "in the opinion of the engineer," and "at the discretion of the engineer" should never be permitted in a specification, because the engineer should occupy the position of a judge, or an interpreter of the specification, but not be permitted to make specifications or rulings that would change the meaning and intent of the specification. Specifications should be clearly written and the thought well defined, so that no misunderstanding or misinterpretation need be possible. Specifications should be full and complete, and no engineer should be permitted to make specifications who does not have a thorough knowledge of the work he proposes to do. Both the engineer and the contractor should enter into the work with a sincerity of purpose, and neither should expect to take unfair or undue advantages of the other. Especially should the engineer be fair to the contractor, as well as to the county, because of the responsibility and the graveness of the position he occupies.

A. D. WILLIAMS,
Chief Road Engineer, State Road Bureau of West Virginia.
Morgantown, W. Va.

SIR:—With reference to your editorial, "Justice to the Contractor," I am very much interested in the subject of correct engineering specifications and the correct engineering administration of public works. There is no question but that the courts will, on proper presentation, give the contractor justice as against the biased engineer, but it is the duty of engineering publications and of engineering schools to educate the next generation of engineers to the knowledge of the fact that, legally, the power of the engineer is limited to the authority given in the contract, and that the courts are not inclined to sustain a contract in which the engineer is the sole arbitrator. In other words, the courts do not recognize the right of parties to decide upon the arbitration of a dispute that has not yet arisen.

Anything that I can do to aid in a movement to correct the conditions you refer to will be cheerfully done.

H. E. RIGGS,
Professor of Civil Engineering, University of Michigan.
Ann Arbor, Mich.

SIR: Regarding the editorial entitled "Justice to the Contractor," published in the Engineering Record, April 15, I am quite in accord with your suggestion that there is a necessity for improvement in the method of compiling specifications. I fail to see, however, how a properly drawn standard specification would correct the narrowmindedness of the inferior and ill-equipped engineers, since they will probably consider that the specifications which they draw will be far superior to those drawn by any engineering society.

Nevertheless, there is certainly room for improvement, and your suggestion that the American Society of Civil Engineers should do extensive work along these lines is a good one. I think a committee for such work should include not only engineers, or contractors, but contractors' engineers.

I am optimistic, however, about the general situation, feeling that the engineering profession as a whole is growing to the realization of the value of a fair deal, whether the fair deal is included in the specifications or not.

I find in many instances, that complaints from contractors are met with more than fair treatment by engineers in charge of work, and I find also a disposition on the part of contractors to be less selfish and narrowminded than they are ordinarily considered to be.

C. J. BENNETT,
State Highway Commissioner.
Hartford, Conn.

SIR: I have read with some interest the editorial "Justice for the Contractor," in the Engineering Record for April 15, especially as I happen to be a member of a committee appointed by the Canadian Society of Civil Engineers at the annual meeting in January, 1914, to consider the question of "Uniform General Clauses for Specifications," the chairman of which is Henry Holgate, M. Am. Soc. C. E.

This committee has had a number of meetings, and at the 1915 annual meeting of the society presented a report embodying draft clauses for the purpose. These clauses provoked a great deal of discussion pro and con, and resulted in the report being referred back to the committee, and certain additions being made to the committee's membership. During 1915-1916 not much was accomplished, owing to wartime conditions in Canada, but it is hoped to present a revised report to the society at the 1917 meeting.

There is no doubt in my mind but that a set of fair and usable general clauses can be drawn up, not necessarily all to be used in any one contract, but from which the engineer may make a selection of such as may fit the case at hand. If the American Society of Civil Engineers can be induced to appoint a committee such as that referred to, on which both engineers and contractors shall be well represented, the results of its labors should be of great value.

Very truly yours,
R. DEL. FRENCH,
Assoc. M. Am. Soc. C. E.
McGill University, Montreal, Que.

## Architect vs. Engineer

SIRS Allow me to commend most heartily the editorial entitled "Architect vs. Engineer," which appeared in your issue of March 25, page 406. It ought to be read by every engineer and architect in the country. Fortunately, the deservedly wide circulation of your paper may be expected to bring it to the notice of many of them.

I feel so strongly the force and the propriety of one paragraph of the editorial that I quote it here, as follows:

"Without a doubt the best plan would be to secure co-operation with the American Institute of Architects to the end that both engineers' and architects' licensing laws be kept off the statute books, and be repealed where now in force. As this journal has long held, such licenses do not make for the safety and welfare of the public. That can only be provided for by examining the work of the engineer and the architect, and not the individual."

The Illinois architects' license law makes it illegal for anyone but a licensed architect to design any building or part of building, and it defines a building as any "structure having foundations, walls and roof, with or without other parts." It was, therefore, illegal for an electrical engineer to design a power plant, a sub-station, or even a conduit or a manhole for light, power, or telephone cables. The railway engineer could not design a tunnel or a covered bridge. The municipal engineer could not design a sewer or even a sewer manhole. The waterworks engineer could not design a pumping station, a filtration plant, a covered reservoir, or a gate house on a reservoir or dam, or even an ordinary gate box. Each of these structures has "foundations, walls and roof, with or without other parts."

The architects' law was passed about twenty years ago, when structural steel and reinforced concrete first came into use for buildings. Both of these materials called for a knowledge of structural design, with which the engineer, generally speaking, was better equipped than the architect. The engineers were asleep and did not oppose the bill; and it is doubtless true that most of the architects themselves did not then fully realize its far-reaching effects. For a long time the architects made no attempt to enforce its provisions, but within the last few years they have been exceedingly active along this line. In view of the announced policy of officers of the local Association of Architects, it became necessary for engineers in Illinois to secure some protection if they wished to continue to practice their profession. The result was the passage in Illinois of the structural engineers' license law, prepared by the legislative committee of the Western Society of Engineers, of which the writer was a member during the last year of its existence.

Both laws should be repealed. Both are, in effect, class legislation masquerading in the guise of measures for the protection of the public. In this, of course, the architects' law is the worst offender, because it was passed first, and because the fact that it was in force made it absolutely necessary for engineers to secure similar legislation. Furthermore, with the architects' law in force, the engineers' law was actually in the interest of public safety, for it restored to the public its right to employ the class of men best qualified to design all structures safely.

Apart from the fact that the engineers' law now gives an engineer the legal right to practice his profession in the state of Illinois, a right of which he was formerly deprived in large measure by the architects' law, neither law is of any real benefit to either profession.

It would be folly to expect that any board of examiners, whether for architects or for engineers, could, by the mere issuance of a license, insure the public against unsafe plans. If it be necessary to protect the public by law against unsightly structures, art commissions could accomplish much; if against unsafe plans, suitable building codes would seem to offer the best solution. In both cases it would be the work which would be judged, and not the man.

Should this deplorable controversy between the two professions continue to spread, the engineers, if they will only bestir themselves—not to secure further class legislation, but simply to prevent architects from doing so—need not fear the ultimate outcome. A committee of the American Society of Civil Engineers has already, as you say, studied the situation, and sounded a warning which all engineers should heed. It seems probable that the American Society of Civil Engineers will soon join with the other engineering organizations in occupancy of the Engineering Societies Building in New York. The writer, for one, sincerely hopes that it will do so. That building will then be the official headquarters of more than thirty thousand engineers from all over the United States, and the power of these men in a just cause ought easily to outweigh the strength of such architects as could be induced knowingly to sanction the promotion of further class legislation.

But it seems too bad that two honorable professions should quarrel over laws so fundamentally wrong. The writer is unwilling to believe that the highest class of men in either profession would, if they thoroughly understood the situation, desire to perpetuate these laws. Neither profession could, of course, repeal its law with safety to itself, unless the other law was repealed at the same time. The only proper thing to do, therefore, would be, as you suggest, for the architects and engineers to join in repealing both laws.

Dabney H. Maury,
Chicago. Consulting Engineer.

## Service of Engineering Societies

Sir: "A society exists to render service to its members." This phrase from the editorial on "Service of Engineering Societies" in the Engineering Record of April 1 should be framed and hung in the meeting room of each society and be printed on its letterheads to keep constantly in mind a fact which too often has been overlooked, but which has now come to be appreciated as never before.

With the recent rapid growth of the national societies with headquarters in New York there has been a tendency to forget this simple fact and to point with pride to mere numbers of membership, apparently overlooking the fact that the larger the membership the larger the responsibility and the duties to the members, and the greater liability to diffusion of effort and lack of efficiency.

Some of the older members of our engineering societies, and particularly the officers, appear to regard the society as an institution almost sacred in itself and as the sum and substance of desirable human effort. They appear to forget that it is simply a means to an end and not the end itself. The accumulation of wealth and a substantial building, and library, may properly be questioned as a desirable achievement if, in the process of adding to the wealth and membership, the society has sacrificed the end for which it was created. Concerning every dollar of membership dues which has been laid aside there may be a proper question as to whether it has been used rightfully, as to whether in being held in reserve it has not resulted in delaying the accomplishment of the purpose for which the society was organized. The possession of a surplus over running expenses, while indicative of good management financially, may be in itself an arraignment of good faith of the management of the society which has taken the membership dues and may not have used them in the best way for the good of the members and through these of the general public.

During the past few years I have had unusual opportunities of meeting engineers of all kinds and in addressing engineering organizations, East and West, North and South. The impression derived is that the smaller, struggling societies, many of them barely avoiding debt, are the ones which are accomplishing the largest results for their members and for the profession in general. This is particularly true of those which bring together the members, representing all branches of engineering, for monthly or semi-monthly meetings, partly social in character and in part devoted to the discussion of technical subjects. These are the ones which may be considered as rendering 100 per cent efficiency for the time and money invested. In striking contrast to these are the larger organizations with greater wealth and with corresponding self-satisfaction. Here the funds are often expended in conducting routine work which, while good in itself, represents only 30 or 40 per cent of possible efficiency.

The question may be asked, "Why do men continue to join these large associations if there is a recognition of this lack of efficiency?" The answer lies in the fact that there has been built up a tradition or sentiment to the effect that it is incumbent, upon the younger men especially, to join a big society and to demonstrate their fitness by being accepted as members. It is frequently urged that their opportunities for securing employment or public recognition will be increased by their being able to wear the badge of the society. Thus arises a certain moral coercion; a man joins and continues to pay annual dues year after year simply because it is considered a proper thing to do and for fear that if he does not do so his business may suffer therefrom.

As a matter of fact, the value of the privilege of wearing the pin of any engineering society is greatly exaggerated. Employers and men of influence in every-day life care practically nothing about it. Personally, I have employed scores of engineers and have been associated in business and otherwise with many others. I have not been able to find that membership in any society, big or little, really counts for, say, more than 1 or 2 per cent in the factors that contribute to success. Wide acquaintance within various societies and without leads to a conviction that the ability to pass the committee on admission is not a very satisfactory test; equally good men are found outside of the societies as well as in, and vice versa. Nevertheless, as before stated, there is a sentiment, which has been carefully fostered, leading men to apply for membership and to continue to pay annual dues, even though they are vaguely conscious that the money which they have contributed is not being used effectively either for the public good or for their own.

The ideals of service necessarily vary in the different organizations, and in many, especially the larger societies, they are extremely vague. The time is coming, however, with the increase in number of engineering societies and with the larger demand for engineers to take part in civic affairs, when every engineer will ask whether the association to which he belongs is not merely holding a high ideal, but is actually working toward it in an effective manner. We may state in general terms that every association of engineers does accomplish some good, but good is a relative term. It means little unless we define it quantitatively. On examination it may be found that the "good" resulting to individuals from membership in one society may be 30 per cent and in another 100 per cent on the investment.

As stated in your editorial, "a satisfied and enthusiastic membership is one which is being adequately served." There is nothing which is more important at the present time than for each and every thinking man to ask the question as to whether he is being adequately served. If not, what is the reason? Is the society too big? Are its headquarters too remote? Does it discourage local option or initiative? Has it fallen into extravagant habits or dropped into a rut? None of us should accept without question the established order nor cease to continually inquire into the efficiency of the organization to which he contributes his annual dues.

The greatest developments of recent years in practical affairs have been those which have resulted from efficiency studies, from elimination of useless details, from the use of high-speed machinery and more effective men. The engineering societies may well profit by the lesson and turn to the benefit of their own members some of the lessons learned by the transportation and manufacturing organizations.

F. H. Newell.

Urbana, Ill.

# HINTS FOR THE CONTRACTOR

## Details Which Save Time and Labor on Construction Work

*Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents*

*[Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

## Types of Rock Drills for Tunnel Work in Chicago Compared

IN DRIVING the Wilson Avenue 8-mile waterworks tunnel, Chicago, described in detail last week, the rock drill question was given considerable study. The results obtained were given by Henry W. Clausen in a paper presented recently before the Western Society of Engineers. After securing all available information both as to what had been done in Chicago and what had been accomplished in other parts of the country since the last rock tunnel was completed in Chicago, the decision was reached that the best way to determine which is the most efficient type and make of drill for any particular rock formation was to equip each shaft with a distinct type of rock drill. Accordingly the old piston type of drill, the water-piston type and the water-hammer type, were used on the work. The results found up to Jan. 1, 1916, were that the most economical type of drill from the standpoint of repair parts is the piston. The fastest drill is the water-hammer drill, but the difference between the drills is not marked in either comparison. The hammer drill, however, uses less air than the piston drill. The specifications called for drills with not less than 2⅝-in. cylinder diameter and a capacity of 10-ft. holes. The cost of the better grade of piston drill of this size is $193, of the water-piston drill, $229.60, and of the water-hammer drill, $280; all equipped complete with a 50-ft. length of hose.

Both the column and heading-bar methods of mounting the drills at the face were tried, and the advantage thus far seems to rest with the column method. Bench holes were drilled from the column or bar as much as possible.

After the tunnel work had advanced for some time it was found advisable to install a No. 5 Ingersoll-Rand Leyner drill sharpener with the necessary dies, dollies, etc. This machine, which is operated by compressed air, holds and forges the steel. The cost of the machine with all appliances was $1,379.55. It is operated by one man and easily performs the work of four blacksmiths and does the work better, said Mr. Clausen.

This work is under the direction of John Ericson, city engineer, with Mr. Clausen, engineer of waterworks construction, in direct charge.

## Paving Mixer Rolls Subgrade While Waiting for Stone

BY SLIPPING 24-in. wide butt-welded tires of ½-in. thick steel over the regular wheels of a paving mixer, made by the Chain Belt Company, a contractor for road construction in Glenwood, Iowa, converted the mixer into a road roller at a cost of $75. The outer half of each new tire was filled with 1 to 2 mixture of sand and cement. Samuel Friedman, the contractor, states that the converted mixer rolled the subgrade with very satisfactory results, although there were several backfilled trenches in the road. Owing to the fact that shipments of coarse aggregate for the concrete were delayed on this work, it was possible to roll the entire subgrade without using a regular roller on the job. The contractor figures that the converted tool will perform several years of good service as a mixer and roller.

MIXER AS ROAD ROLLER

## What Is Best Way to Cut Blocks from Concrete Pier?

SIR: Will you please tell me how to cut out a piece of concrete from the corner of a pier in one lump so as to make a neat job and not injure the rest of the work? Although I have been in construction work all my life this is the first time I have come across a piece of work of this kind. I used plugs and feathers, spacing the drill holes on 4-in. centers, but it made a poor job.

WILLIAM J. STRATTON,
U. S. Reclamation Service.
Gilman, Mont.

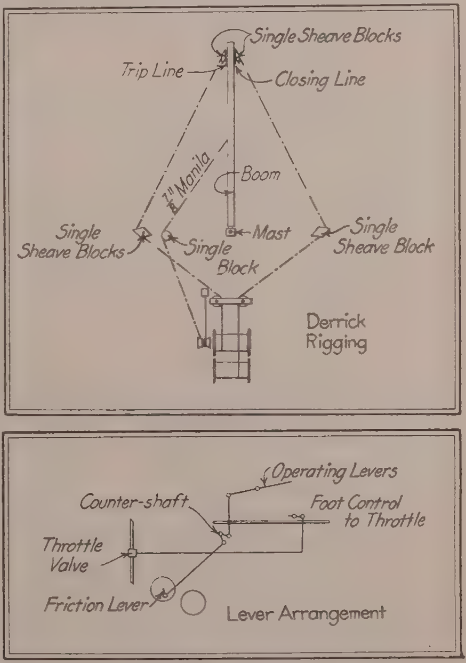
[Perhaps some reader of the Engineering Record can suggest a good method of doing this work. An inclosed sketch indicates that the pieces to be cut from the pier, which is 4 ft. thick, are at the upper corners, are 3 ft. 3 in. high and 3 ft. deep, and extend through the pier from side to side. Perhaps the work could be done by using small steels, drilling a row of holes as close together as possible downward from the top of the pier and another row inward horizontally from the 4-ft. face, and cutting out the walls between the holes as far as possible with a chisel steel used in the drill. As there is stated to be no reinforcement in the pier, it should be possible by careful drilling to take the block out very neatly. The horizontal holes would be drilled and the walls between them cut, of course, before the vertical holes are started.—EDITOR.]

## Quick-Operating Rig for Grab Buckets Uses Two-Drum Hoist

By WILLIAM G. BROADHURST
F. R. Long-W. G. Broadhurst Company,
Hackensack, N. J.

FOR HANDLING material with a grab bucket from one point to another where the elevation of the boom does not have to be changed, as in unloading material from barges at a water-front plant, a rig arranged as indicated in the accompanying sketch and operated with a two-drum hoist is much more rapid and efficient than the average clamshell derrick swung with a bull wheel.

The closing line is run from the bucket through a swivel-hook, single-sheave block hung at the end of the boom on the right side, then through a loose-hook, single-sheave block well off to the right side at the level of the foot of the boom, then through a guide sheave fixed so as to lead the line to the upper drum of the hoist. The trip line is run from the bucket in the same way, but on the left side of the boom. The operator stands on a platform set so that he can see the whole operation of the bucket. The brakes are removed from the engine and the drums are operated and controlled only by the frictions. There are two oper



DERRICK HANDLES GRAB BUCKET WITHOUT BULL WHEEL OR THIRD DRUM ating levers placed parallel about 30 in. apart at such an elevation that the operator can stand between them and raise and lower them one with each hand to control the friction levers of the drums. The throttle is controlled by a foot treadle directly in front of the operator.

To operate the rig, beginning at the point of loading, the throttle is opened with the foot control, the right-hand lever pushed down and the bucket closed, loaded and raised clear. At the same time the left-hand lever is held down just enough to take up the slack on the trip line on the lower drum. The bucket swings to the right with the boom, which is pulled around by the side lead of the closing line. Enough tension is kept on the trip line to keep the boom from swinging too fast. When the bucket reaches the dumping point the closing line is slacked and the trip line held, opening the bucket. The trip line is then wound in, reversing the operation and pulling the boom back to the loading point.

If the empty bucket is not heavy enough to furnish the tension in the trip line required to swing the boom back at a rapid rate, a tag line, rigged as indicated in the sketch, may be used to help. A manila line is attached about half way up the boom, rove through a single block at about the elevation of the winch head, given several turns around the winch head and then rove through a set of double-sheave blocks hung from some point on the derrick. To the lower block of this set of falls is hung a weight of about 50 lb. The weight and the number of turns on the winch head are adjusted so that there is just enough pull in the line to start the boom swinging back from the dumping position. The weight of the loaded bucket will furnish enough tension in the closing line to overcome the pull on the manila line when the boom is swinging with a load.

With practice an operator can learn to handle this rig with great speed. With a 1-yd. clamshell bucket 500 to 600 cu. yd. of ashes or similar material may be unloaded from a scow in 9 hr.

[The rig described operates on the same principle as the 5-yd. orangepeel dredge boats common about Eastern harbors. Such a rig, which is rarely seen away from the Atlantic seaboard, might be used profitably in many places on construction work. It might be added that the dredge boats are usually rigged with chains instead of wire rope, and that usually a tag line is not needed with the heavy buckets.—Editor.]

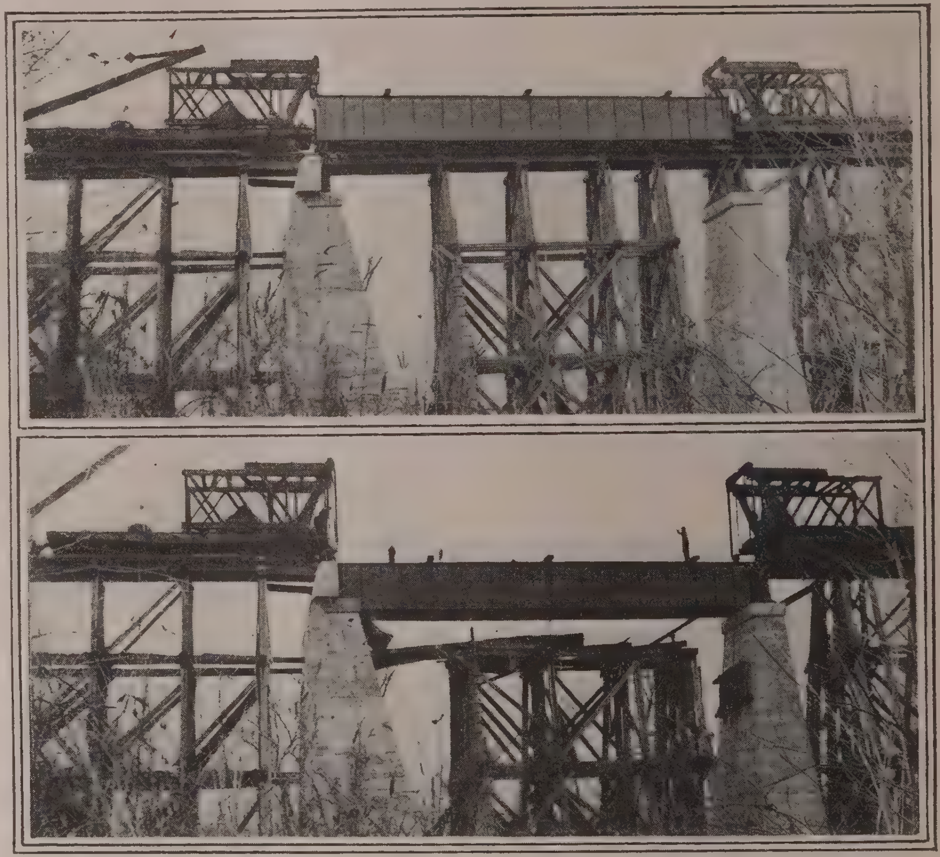
## Use Gasoline Engine Successfully in Chicago Tunnel

Five-ton gasoline locomotives with the exhaust gases thrown off through a water box to remove the smoke and unburned gasoline operate the trains of muck cars in the Wilson Avenue tunnel, Chicago, described in the Engineering Record of April 29, 1916, page 568. The small quantities of CO and $CO_2$ remaining are ordinarily sufficiently diluted to be unobjectionable, according to Henry L. Clausen, engineer of waterworks construction, in a paper recently presented to the Western Society of Engineers. The four-wheel type locomotives are driven by 40-hp. four-cycle, four-cylinder engines running at 800 r.p.m., and can attain a speed of 8 miles per hour, at which they can develop a drawbar pull of 900 lb. They were furnished from special city specifications by the Baldwin Locomotive Works. In the Wilson Avenue tunnel they usually pull trains of twenty to twenty-five loaded 1-yd. cars, and in an emergency as many as fifty-seven loaded cars.

## Frames on Flat Cars Erect Railroad Girder Bridges

By C. L. KETCHAM
Pleasanton, Kan.

The carrier cars, shown in the accompanying photographs in the act of placing a 70-ft. deck plate girder span, are in use by the St. Louis & San Francisco Railroad for setting girders up to 100 ft. long in replacing lighter bridges and trestles. The two frames shown were erected on standard flat cars at a cost of $150 without injuring the cars for future service. Ordinarily no hoisting equipment is used.



SET IN THIRTY MINUTES, THESE GIRDERS WERE HANDLED WITHOUT HOISTING EQUIPMENT

For this replacement work the girders are nearly always delivered a few days before the time to set them. They are unloaded from the flat cars at a convenient point near the bridge onto cribbing the same height as the floor of the car. When a span is to be set, one of the carrier cars is spotted at each end of it, and cribbing built on the track between these cars. The girder span is then slid over into place between the cars. Next, manilla rope lowering tackles hung from the frame on each car are attached to the ends of the girder span. The span is then raised on jacks, the cribbing on the track removed and the span lowered a little way on the jacks till the tackles are taut. The lead lines from these tackles are snubbed around lengths of 5-in. gas pipe secured to the upright members of the frames.

When the weight of the span is on the cars, the whole train is pushed out into place to set the new span by a locomotive. When the cars have to be pulled they must be held together by a wire-rope line. It is for this purpose that the derrick car shown in the accompanying photographs had been used. When the cars are pushed no coupling is necessary, as the advanced car can be stopped accurately with the hand brake.

The rails over the bridge or section of trestle to be replaced are cut beforehand, and short lengths put in. This makes it easy to take out the old trestle or span in a short time. It is then only a matter of a few minutes to lower the new span into place with the supporting tackles. With spans shorter than 70 ft. the new deck is usually placed on the girders before leaving the side track with them.

The time consumed in placing the girders shown in the accompanying photographs was only 30 minutes after the carrier cars were spotted. The entire process of cutting the old rails, setting the girders and replacing the track was done on one occasion in 50 minutes between trains on a busy section of the main line. The girders set in this instance were also 70 ft. long. Girders have been set in this way at a cost of 50 cents a ton or less.

The writer is in the service of the St. Louis & San Francisco Railroad as superintendent and inspector of steel bridges.

### Status of American Ship Building

According to returns made by builders to the Bureau of Navigation, Department of Commerce, there were building or under contract on March 1, 1916, in American shipyards 244 steel merchant vessels, having a gross tonnage of 945,798.

# NEWS OF THE WEEK

**Passing Events in the Civil Engineering and Contracting Fields**

## Will Dedicate New Technology Buildings June 12

**Elaborate Ceremony Planned to Mark Removal of Institute from Boston Site to Cambridge—Prominent Educators Will Attend**

With elaborate ceremonies, including a pageant and masque delineating man's progress in conquering the forces of nature, the transfer of its archives from Boston across the Charles River in a lavishly decorated Venetian barge, a water carnival, alumni reunions, and formal exercises in which distinguished educators, statesmen and men of affairs will participate, the Massachusetts Institute of Technology, on June 12, 13 and 14, will celebrate its fiftieth anniversary and dedicate its imposing group of new buildings on the banks of the Charles River in Cambridge, Mass. For the three-day celebration, separate programs have been arranged for the alumni, the undergraduates, and guests from other institutions of learning, but the activities of these three groups will intermingle, to some extent, so that while the units will enjoy themselves in their own ways the whole great mass of people will be together at times when the interests of the occasion are common to all.

The formal exercises of dedication will be held on Wednesday, June 14. The arrangements are in the hands of committees of which Franklin W. Hobbs, Jasper Whiting and Frederick P. Fish are chairmen. Two hours in the morning are to be devoted to an inspection of the new buildings. At 2:30 p. m. the academic procession will start its march to the Court of Honor, where the exercises will be held. Dr. William T. Sedgwick will act as chief marshal. At 3 p. m. President Richard C. Maclaurin will welcome the visitors and delegates, Governor McCall of Massachusetts and President Lowell of Harvard will make brief addresses, while the orator of the afternoon will be Senator Henry Cabot Lodge. Delegates from colleges throughout the United States and Europe will be present, together with presidents or other representatives of a hundred scientific and literary associations.

### Spectacular Pageant Planned

Tuesday, June 13, will be alumni day. Thousands of Tech men are planning to be in Cambridge to do honor to their alma mater and will witness, in the evening, a masque and pageant on a stupendous scale. The spectacle will illustrate "The Conquest of Chaos by Technology," and will be staged in the Court of Honor at the new Technology. The arena will be filled with thousands of elements—students and other participants—in chaos and confusion. Primordial man will be represented by a group of the huskiest of Tech students selected for their physical prowess. Again and again savage man enters the circle and is flung out by the forces that do not know his bidding. Growing more and more intelligent and calling to his aid great principles working with Reason, Will and Skill, symbolical characters which come to his aid, man subdues Chaos and order and civilization are established. This is a bare outline of the subject which originated in the imagination of Prof. R. A. Cram, senior professor in the department of architecture.

### Transfer of Archives

One of the most important spectacular features of the celebration will be the water festival on Monday afternoon, June 12 in Charles River basin. On the following afternoon, as an introduction to the masque and pageant, there will be the formal transfer of the archives of the Institute from the Rogers Building in Boston, their home for fifty years, to the new site in Cambridge. Following an old Venetian custom the corporation and faculty members will embark in an elaborately decorated barge, 100 ft. long, designed especially for this occasion by Professor Cram, with sculptured decorations by Hugh Cairns. This vessel will carry the dignitaries across the Charles River basin to the new Technology.

### Alumni Will Celebrate

Many alumni celebrations are planned for Monday, June 12. Delegations will reach Cambridge from all parts of the country and a round of festivities for their entertainment has been provided.

The new buildings for the Massachusetts Institute of Technology have been described in a number of articles in the Engineering Record and the construction methods were given in detail in the issue of Nov. 28, 1914, page 578. The financing of the edifices for this great institutional plant, involving gifts aggregating about $9,000,000, has been in the hands of President Richard C. Maclaurin who, at the same time, has carried forward the educational program of the Institute.

TO THESE NEW BUILDINGS ON THE BANKS OF THE CHARLES RIVER IN CAMBRIDGE, MASS., THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY IS NOW READY TO MOVE FROM ITS SITE IN BOSTON

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## Engineers Hold Exhibit

The Scranton and Northeastern Pennsylvania corps of engineers recently held a recruiting exhibit at Scranton. Working models and pictures of military bridges and war equipment were shown, with the result that forty recruits were enrolled.

## Two Closely Allied Conferences Held at Washington

**One in Connection with American Institute of Electrical Engineers—Other a Part of American Electrochemical Society Meeting**

Two closely allied conferences were held last week in Washington, D. C., one under the auspices of the committee on development of water-power and the Washington (D. C.) section of the American Institute of Electrical Engineers and the other as part of the general meeting of the American Electrochemical Society.

Wednesday's meeting dealt with the engineering and economic question of water-power development as related to national industrial efficiency and preparedness. The Thursday afternoon session was devoted to discussion of Niagara Falls power and American industries. A. P. Davis, chief engineer of the U. S. Reclamation Service, gave an illustrated lecture on the federal water-power projects.

In a paper entitled "Electrochemical Industries and Their Interest in the Development of Water Powers," Lawrence Addicks pointed out that those industries offer nearly ideal loads of considerable magnitude for central stations. He also said that electrical energy must be obtainable at even less cost than at Niagara Falls before it will be in marked demand for electrochemical purposes. While the available energy must be near the electrochemical market and source of supply for raw materials, the nature of the industry determines whether energy, transportation charges or labor cost is the ruling factor in the location of the plant. In variance with expressed opinions electrochemical plants can seldom be operated on off-peak power, declared the speaker. These industries, so far, have not found it economical to develop their own power singly, but, in time, may co-operate to develop energy as a group. In view of the foregoing considerations, a liberal water-power policy on the part of the government would be a step toward making inexpensive energy available for this extensive industry.

### Water Power and Transportation

Some of the conditions which determined the value of water-power in relation to transportation, and how it may change with progress and changes in interest rates demanded for capital, were outlined in a paper by Lewis B. Stillwell, entitled "Relation of Water Power to Transportation."

Estimates were given on the approximate economic limits to investments in hydroelectric plants when coal can be obtained for steam plant operation in the vicinity at $1 to $5 and when the capital charges are 9, 12 and 15 per cent. It was pointed out that if water power has to be supplemented by steam reserve equipment, the amount that can be economically invested in a hydroelectric plant is reduced by the cost of the steam plant. Attention was also called to the fact that the decreased cost of steam-power plants and increased fuel economies obtained in recent years, have considerably reduced the limits to economical investment in water-power plants.

### Discussion

In the discussion which followed, Dr. Leo Baekeland, of New York City, told of the power famine confronting electrochemists and how the industry cannot go forward without cheap and abundant power. He complained of the wasteful methods of financing in this country. He stated that a development is saddled with investment charges of 9 per cent before operations begin, while in Europe the money costs about 4 per cent. Fertilizers, he said, cannot be made where a plant has such fixed charges for capital because energy must be extremely cheap. No plant having to pay $9 yearly on a $100 investment can make energy cheaply enough for the fixation of nitrogen.

J. J. Carty blamed the government for the high rates which prevail. If it would remove the uncertainties about the tenure of the grant, bankers would be content to recommend the investment at lower costs. Give the investment stability and money would be cheaper. Everything, he said, should be done to conserve the coal of the country, and this can best be done by developing the water-powers.

### Hard to Procure Capital

Certain aspects of investors' attitude toward water-power developments were presented in a paper by Gano Dunn, entitled "The Water-Power Situation, Including Its Financial Aspects." It was pointed out that actual and threatened laws, popular prejudices and some cases of unprofitable developments have retarded water-power developments. Physical and natural difficulties also handicap hydroelectric plants, as compared with steam plants, making it essential that a reasonable profit be offered to induce investment of capital.

On account of the increasing cost of labor and materials, increasing taxation, and the fact that the effieciency of converting water-power to electric power has practically reached a maximum, the cost of generating hydroelectric power is increasing and will continue to do so. On the other hand, steam-electric energy is decreasing in cost because continual improvements in converting heat energy into electrical energy have been made and may be expected.

At the meeting of the American Electrochemical Society, Thursday afternoon, four papers were presented by I. R. Edwards, F. J. Tone, A. H. Hooker and W. S. Landis. The discussions were on water-power development at Niagara Falls, electric furnace products, electrochemical processes and nitrogen fixation processes. H. J. Pierce lectured that evening on American and foreign water-powers and electrochemical industries.

## American Society Board Changes Rules Governing Admissions

Several revisions in the rules adopted by the board of direction of the American Society of Civil Engineers last January were made at a meeting of the board held on April 18. Rule 1 (see page 35 of the year book), stating that the qualifications for admission to any grade must clearly exceed the minimum requirements of the constitution, now states that the qualifications must be shown to clearly equal the requirements of the constitution. Rule 2, regarding references, is practically unchanged. Rule 3, requiring markedly superior professional experience for admission of applicants engaged on work for which engineering education is not essential, has been omitted. Rule 4 has been modified as Rule 3 to the following form: "In considering the requirements for the grade of member, the words 'responsible charge of work' shall be interpreted to refer to work of considerable magnitude for which rule-of-thumb methods are not sufficient." Rule 5, stating that a candidate shall be admitted as member only by transfer from the grade of associate member unless eminently qualified, has been omitted.

## Shields Bill Endorsed by Conservation Congress

After a bitter fight in which the so-called conservationists, headed by Gifford Pinchot, made the usual charges of convention-packing by the power interests, the National Conservation Congress in session in Washington, D. C., May 3, adopted a resolution endorsing the Shields bill. The vote was 116 to 39. The Shields bill would permit the granting of franchises, irrevocable for 50 years, for the construction of power plants on navigable streams. The Pinchot following contended that sufficient degree of control was not retained by the government to protect the interests of the public.

The merits of the bill were discussed editorially in the Engineering Record of April 8, 1916, page 469.

## Pennsylvania Will Build Large Hotel in New York

Plans have been made public by the Pennsylvania Railroad regarding the large hotel to be built by its subsidiary, the Pennsylvania Terminal Real Estate Company, across Seventh Avenue from the Pennsylvania Station in New York. The Hotel Pennsylvania will occupy the property fronting 200 ft. on Seventh Avenue and 400 ft. on Thirty-second and Thirty-third Streets. At present it will have a three-story section twenty stories high on Seventh Avenue, with a three-story section in the rear, and will contain 1000 bedrooms. The low section will be designed, however, to be carried up when necessary to the full height of twenty stories, thus giving 1200 additional rooms. Large rooms will also be provided for conventions.

The architects and the contractor will be the same as for the Pennsylvania Station opposite —McKim, Mead & White and the George A. Fuller Company respectively. The hotel is to be opened in 1917.

## Concrete Dam of C. P. R. at Moose Jaw Slides on Base

### Gravity Type Water Supply Structure 300 Feet Long Moves About 15 Feet Downstream When River Rises

While the water is still too high for a verification of the cause of the accident, it is probable that the failure of the Canadian Pacific Railway's concrete dam at Moose Jaw, which occurred on the morning of April 24, was due to the sliding of the structure upon its foundation. The dam across the Moose Jaw River is of the gravity type, about 300 ft. long, divided by buttresses into eighteen sections, nine of which are provided with stop gates. The downstream face had no concrete apron but was protected by stone riprap. The stop logs were all removed at the time of failure.

It is believed that the dam did not break but slid forward about 15 ft. on its foundation, due to the washing away of the riprap protection. It is not possible, at this writing, to verify this conclusion.

According to old residents in Moose Jaw this year's spring run-off has been equaled only once during the past thirty years, in 1905. In both years of high water the low lying and built-up portions of the city were flooded about 2 ft. deep.

Moose Jaw is the general divisional headquarters for the Canadian Pacific Railway's system in the Province of Saskatchewan and is the site of large repair shops. The railway company is partly dependent on the impounding reservoir formed by the Moose Jaw dam for its water supply for operating purposes.

## Pennsylvania Railroad Reorganizes Operating Department

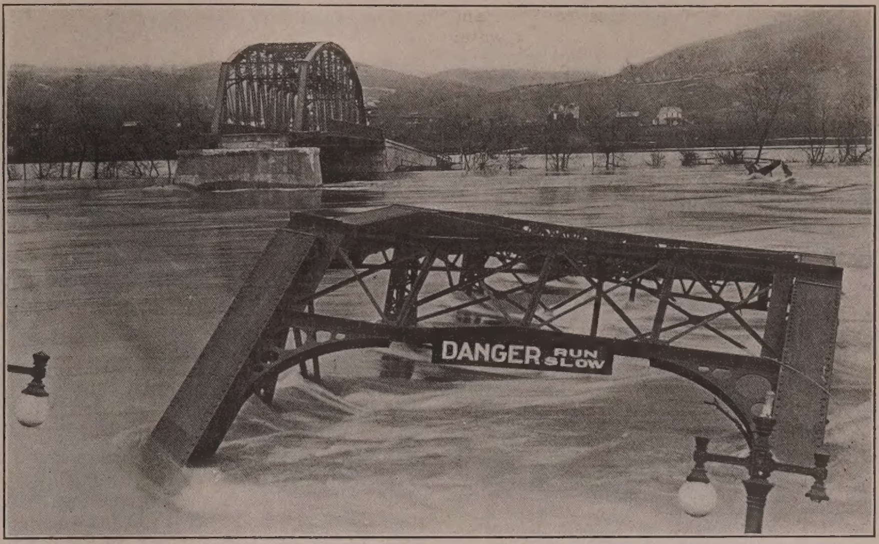
The operating department of the Pennsylvania Railroad was radically reorganized, and two new positions created, at the directors' meeting in Philadelphia, April 26. The two new offices are those of assistant general manager and resident assistant in New York, to the vice-president in charge of operation.

The Baltimore division south of Wago, including the York branch and the York, Hanover & Frederick Railroad and the north end of Bay View yard, comprise a new Baltimore division which is attached to the Philadelphia, Baltimore & Washington Railroad. The Baltimore division north of Wago has been attached to the Eastern Pennsylvania division. Rockville, Pa., is the southern terminus of the Central division. The Media division has been consolidated with the Maryland division of the Philadelphia, Baltimore & Washington.

**Students at Johns Hopkins University Practice Military Engineering**

THIS MILITARY BRIDGE WAS ERECTED BY 28 STUDENTS AT JOHN HOPKINS UNIVERSITY IN ABOUT A DAY'S TIME. THE PRINCIPAL PART OF THE WORK, CONSISTING OF LASHING THE BENTS TOGETHER, WAS DONE IN LESS THAN 6 HOURS. COST OF CONSTRUCTION WAS APPROXIMATELY $70, FOR ROPE, PLUS THE LABOR OF CUTTING THE TIMBER. THE SAWN LUMBER WAS ON HAND. THE STRUCTURE WAS TAKEN DOWN IN TWO HOURS. THE MILITARY ENGINEERING PRACTICE IS THE RESULT OF A SUGGESTION BY C. J. TILDEN, PROFESSOR OF CIVIL ENGINEERING. THE DESIGN IS THAT USED BY THE WAR DEPARTMENT.

The changes made May 1 include the following: C. S. Krick, formerly acting general superintendent of the New Jersey division, has been appointed general superintendent. Elisha Lee has been promoted from the position of general superintendent of the Philadelphia, Baltimore & Washington Railroad to assistant general manager. R. V. Massey, formerly superintendent of the Manhattan division has been appointed to a similar position on the New York division, formed by consolidating the New York and Manhattan divisions. F. W. Smith has been promoted from the position of division engineer of the New York division to become assistant superintendent of that division. J. H. Harris, formerly division engineer of the Manhattan division, now holds a similar position on the New York division. G. R. Sinnickson has been promoted from superintendent of the Schuylkill division to a similar position on the Baltimore division. He is succeeded by J. J. Rhoads, formerly superintendent of the Media division. J. H. Gumbes, formerly superintendent of the Renovo division, is superintendent of the Philadelphia Terminal division.



**Athens Bridge Washed Out by Underscoring of Intermediate Pier**

AS DESCRIBED IN THE EDITORIAL ON PAGE 534 OF THE ENGINEERING RECORD OF APRIL 22, TWO RECENTLY COMPLETED BRIDGE SPANS OVER THE SUSQUEHANNA RIVER, AT ATHENS, PA., FAILED DUE TO FALSE ECONOMY IN USING OLD TIMBER CRIB PIERS BUILT IN 1840. THE CENTER SPAN TURNED COMPLETELY OVER AND CAN BE SEEN ABOVE WATER IN THE DISTANCE. THE NEAR SPAN (ATHENS END) SETTLED WITHOUT SHOCK, AS EVIDENCED BY THE UNBROKEN LIGHT GLOBES IN THE FOREGROUND OF THE ILLUSTRATION

## Nominate Officers for Testing Materials Society

Last week the nominating committee of the American Society for Testing Materials announced the following nominations to be voted on previous to the coming annual meeting to be held June 27:

For president, A. A. Stevenson; for vice-president, S. S. Voorhees; for members of executive committee, W. H. Bassett, John Brunner, G. W. Thompson and F. E. Turneaure.

The executive committee announces that the total membership on April 20, 1916, was 1963 members, a net increase of 121 since June 15, 1915. The largest net gain in membership for the yearly period between annual meetings was 155, reported last year, but during that year the net gain from the date of the annual meeting of 1914 to April 20, 1915, was only 71 as compared with 121 this year. It is confidently anticipated by the committee, therefore, that the total membership at the time of the approaching annual meeting will be substantially above 2000.

As announced elsewhere in these columns, the annual meeting this year will consume only four days, the Saturday morning session, customary in the past, being eliminated.

**The Best of Footings None too Good for New York Subway**

We are down to Solid rock I can smell Sulphur in the cracks.
All right, we will finish off the bottom. Here Comes the Manicure now.
What is all that blasted noise I hear? There has been a terrible smell of fresh air down here lately

Seamy rock was found in excavating the column footings for New York City's new Lexington Avenue subway station opposite the Grand Central Terminal. As these columns are on private property and will have to support a heavy building, the engineers of the Public Service Commission had all excavations carried down to solid rock and well cleaned up to make sure that no stray fissures remained undetected. The cleaning was carried out with the nicety, so it is said, of manicure operations. The extra excavation was done under Article XII of the contract. Robert A. Shailer, tunnel engineer for the contractors, the Rapid Transit Subway Construction Company, on learning one morning that the extra excavation would hold up the work of concreting the footings for another week, is rumored to have consigned Article XII to the lower regions with some heat. Less than an hour afterward our informant, who had been down "in the bottom" in the meantime, rushed up to the office with a huge chunk of sulphur crystals, mined from the depths, and the greeting "we're almost there with Article XII, Mr. Shailer."

The cartoon is from the pen of George Perrine, Mr. Shailer's assistant.

## Engineers Protest Against Engineer's Removal from Office

The removal of Leon H. Nishkian from his position in the building department of San Francisco was the subject of discussion at a recent meeting of the San Francisco Association of Members of the American Society of Civil Engineers. Political reasons are said to have been the cause of the removal.

The following resolution was adopted at a recent meeting of the association:

"Resolved, that the San Francisco Association of Members of the American Society of Civil Engineers expresses its confidence in the impartial, trustworthy, fearless and competent way and manner in which Leon H. Nishkian has conducted the work in his office as structural engineer to the building permit department, and our regrets as to the removal from his position."

Copies were sent to the Mayor, Civil Service Commission, and various publications.

## American Society for Testing Materials Will Meet June 27

The nineteenth annual meeting of the American Society for Testing Materials will be held in the Hotel Traymore, at Atlantic City, June 27 to 30. The first day will be devoted to miscellaneous reports and papers on heat-treatment of steel. Reports on steel and iron, and on tests and testing will be presented the second day, while the last two days will be devoted to reports on cement and concrete, ceramics and road materials, non-ferrous metals, cast-iron and miscellaneous material.

## 1700 Engineers Apply for Admission to Military Lectures

Invitations from the Engineers' Society of Western Pennsylvania to engineers to attend a series of military engineering lectures at Pittsburgh, brought favorable replies from nearly 1700 technical men. The first lecture was delivered May 3 by Lieut.-Col. F. R. Shunk. The next meeting will be held May 10, in Carnegie Music Hall, at which Major P. S. Bond will discuss military reconnaissance, sketching and surveying, and military demolitions.

## Atlanta Must Pay for Its Garbage Plant, Court Rules

Upholding the claims of the Destructor Company, of New York, Judge W. T. Newman, in the federal court last month, settled the long-standing controversy over payment for the garbage disposal plant at Atlanta, Ga., by a decision calling upon the city to pay the company $135,000 due on the plant and other expenses to be determined at a later date. The court's opinion took the form of a denial of the city's bill of exceptions to the report of Frank E. Callaway, the special master. That report upheld the company's claims in practically every important detail.

In closing its opinion, the court said:

"I may add to all that has been said that the manner in which the plant has destroyed the refuse of the city during the past one and a quarter years seems to show clearly that the city must necessarily take it and pay for it, the only real question being what it should pay for the extra cost of operation from the time stated.

"The trifling amount of refuse not completely destroyed, as has been discussed, is not sufficient to justify any serious objection to the working of the plant, and the steam product being satisfactory, although not used at all now, there is nothing left as to which there ought to be any reasonable discussion. As soon as the amount the company is entitled to recover, if anything, for the excess cost of running the plant and for usual and ordinary repairs, as indicated herein, is determined, a decree may be entered in accordance with it."

## Heavy Storm Does $125,000 Damage at Louisville

A sudden rain and hail storm in the center of Louisville, Ky., April 20, caused damage to buildings amounting to nearly $125,000. The first indication of danger was a black funnel-shaped cloud which swooped down, ran only a few blocks and then lifted.

The J. B. Wathen distilling buildings were unroofed and a large smokestack blown down, resulting in about $50,000 damage. The loss at the Glencoe distillery amounted to $30,000, and at the Sunny Brook plant two large stacks were destroyed, damage amounting to $25,000.

## National Fire Protection Association Will Meet May 9

The twentieth annual meeting of the National Fire Protection Association will be held May 9-11, in the Insurance Exchange Building, Chicago. Reports will be presented on automatic sprinklers, standardization of pipe and pipe fittings, automobile fire apparatus, protection of openings in walls and partitions, standpipe systems, fire pumps and hose, fire-resistive construction, uses of wood in building construction and explosives and combustibles.

## Nine Counties Represented in Flood Control Association

Nine counties were represented in the Southern Counties Flood Control Association recently organized in Los Angeles for the purpose of inaugurating a campaign to meet flood control needs in that district. The association adopted a resolution urging an appropriation by Congress, at this session, "in as large amounts as those recommended by the Secretaries of Agriculture, Interior, Commerce and War, for immediate use in flood control in Southern California and the Colorado River."

### $200,000 Fire in Raleigh

Fire in the business section of Raleigh, N. C., May 2, destroyed seven buildings, with an estimated loss of $200,000.

## Engineering Society Activities

**The Canadian Society of Civil Engineers** heard George H. Montgomery give a lecture on "The Law and the Engineer," April 27, at Montreal.

**The American Association of Engineers** will hold its first annual convention May 9 and 10 in the rooms of the Western Society of Engineers at Chicago.

**The Western Society of Engineers** will hear Gaylord Cummin, city manager of Jackson, Mich., talk on "Opportunities for Engineers in City Management" May 15.

**The American Society of Civil Engineers**, at a meeting May 3, enjoyed a paper by H. H. Wolff, entitled "Design of a Drift Barrier Across White River, Near Auburn, Wash."

**The Oregon Society of Engineers** heard Dr. W. J. Kerr, president of the Oregon Agricultural College, discuss the engineering work of the college and its relation to that work of the state, at the April 28 meeting, in Portland.

**The Seattle Association of Members of the American Society of Civil Engineers**, at a recent meeting in that city, voted favorably on the affiliation of the society with the United Engineering Society as an additional founder society.

**The Illinois Section of Members of the American Society of Civil Engineers** discussed the change of headquarters of the society at the April 24 meeting. The majority of those who spoke, including Onward Bates, president of the section, favored the move to Thirty-ninth Street.

**The Utah Society of Engineers** at the annual election and banquet held April 19 at the Hotel Utah, in Salt Lake City, elected Guy Sterling, civil and mining engineer of that city, president of the society. C. J. Ullrich, assistant state engineer, was elected first vice-president; W. A. Wilson, second vice-president; L. H. Krebs, treasurer; Hugh C. Lewis, secretary, and R. B. Ketchum, member of the executive committee.

## What Engineers and Contractors Are Doing

Theodore Speiden, Jr., formerly superintendent of the Nashville and Chattanooga divisions of the Nashville, Chattanooga & St. Louis Railway, has been promoted to the position of assistant general manager, with headquarters at Nashville.

Clyde Potts, consulting engineer, of New York City, has been retained to design a sewage-disposal works for the city of Oneonta, N. Y. Frank M. Gurney is city engineer.

Herbert C. Keith, consulting engineer, of New York City, has removed his office to 154 Nassau Street.

Arthur M. Field, formerly in the consulting engineering business in Rochester, N. Y., has been appointed city manager of Winchester, Va.

Francis T. Crowe, who has been employed on drainage work on the Boise project of the U. S. Reclamation Service during the winter, has returned to Jackson Lake, Wyo., to work on the enlargement of the dam there.

James H. Graham, Jr., was recently appointed to the position of state building inspector for the Pennsylvania department of labor and industry, with headquarters at Harrisburg, Pa. He was formerly connected with the firm of Chester & Fleming, consulting engineers, of Pittsburgh, where he was engaged in valuation of public utilities.

William F. Cocke has been appointed road commissioner for the state of Florida.

W. A. McTighe, formerly assistant city engineer of Memphis, Tenn., has become a member of the engineering firm of Baum & Haynes, of Texarkana, Ark.-Tex. The new firm will be known as Baum, Haynes & McTighe.

Thomas S. McAllister, formerly recorder in the valuation department of the Boston & Albany Railroad, has resigned from that position to accept an appointment as assistant in the chief engineer's office of the Rutland Railroad, at Rutland, Vt.

J. M. LeGrand, formerly assistant engineer for the United Verde Copper Company, of Clarkdale, Ariz., has become associated with the engineering department of the Canadian Copper Company at Copper Cliff, Ontario.

William J. Gilbert has been promoted from the position of transitman for the Pennsylvania Railroad to that of assistant supervisor at East Greensburg, Pa.

William N. Hall, in the employ of the U. S. Drainage Service, has been transferred from Salt Lake City to Chillicothe, Mo.

Elisha Lee, formerly general superintendent of the Philadelphia, Baltimore & Washington Railroad, has been promoted to the newly created position of assistant general manager of the Pennsylvania Railroad. Mr. Lee was born at Chicago in 1870. He was graduated from the Massachusetts Institute of Technology in 1892 and later in that year joined the office of the assistant engineer of the Tyrone division of the Pennsylvania Railroad. He was promoted to the position of assistant supervisor in 1899 and in 1901 was made supervisor. 1903 found him in the position of division engineer and three years later he was appointed engineer of the Philadelphia Terminal division. Mr. Lee was made principal assistant engineer of the Philadelphia, Baltimore & Washington Railroad in April, 1907, and, two years later, was promoted to the position of superintendent of the New York, Philadelphia & Norfolk Railroad. In 1911 he was made assistant to the general manager of the Pennsylvania and later was appointed general superintendent of the Philadelphia, Baltimore & Washington.

C. S. Krick has been advanced from the position of acting general superintendent of the New Jersey division of the Pennsylvania Railroad to that of general superintendent of that division. Mr. Krick was graduated from Lafayette College in 1887 and immediately entered the engineering department of the Pennsylvania. His recent promotion comes after 29 years' continuous service with that road.

R. V. Massey, formerly superintendent of the Manhattan division of the Pennsylvania Railroad, has been appointed superintendent of the New York division, formed by a consolidation of the Manhattan and New York divisions. Mr. Massey was graduated from Sheffield Scientific School in 1892, after which he entered the construction department of the Pennsylvania. He has been in the employ of that road since graduation.

F. W. Smith, Jr., until recently division engineer of the New York division of the Pennsylvania Railroad, was appointed assistant superintendent of that division, May 1.

J. H. Harris has been appointed division engineer of the New York division of the Pennsylvania Railroad, the duties of which office combine those of the division engineer of the old New York division and those of the engineer of the Manhattan division, which latter office was formerly held by Mr. Harris. He entered the engineering department of the Norfolk & Western Railway and later went to the Pennsylvania in 1894. He has been with that road ever since, rising to the position of engineer of the Delaware division in 1909, after which his promotion to engineer of the Manhattan division followed shortly.

FRED KELLAM has recently become connected with the Cadillac Engineering Company, of Cadillac, Mich.

J. E. MORELAND, formerly resident engineer for G. B. Howard & Company, engineers, of Nashville, has been appointed county engineer for Marion County, Tenn., where it is expected that $100,000 will be expended for road building.

J. J. RHOADES, formerly superintendent of the Media division, has been appointed to a similar position on the Schuylkill division of the Pennsylvania Railroad. He has been in the employ of that road since 1889, during which he has been successively supervisor, assistant engineer and division engineer. He was appointed superintendent of the central division in 1913.

J. H. GUMBES, superintendent of the Renovo division of the Pennsylvania Railroad since 1913, has been made superintendent of the Philadelphia Terminal division of that road. Mr. Gumbes was graduated from the University of Pennsylvania in 1888 and immediately thereafter entered the employ of the Pennsylvania. He rose to the position of assistant superintendent of the Pittsburgh division in 1911.

G. R. SINNICKSON has been transferred from the position of superintendent of the Schuylkill division of the Pennsylvania Railroad to fill a similar office on the Baltimore division. Mr. Sinnickson has been in that road's employ since his graduation from Princeton University in 1897.

R. M. PATTERSON has been advanced from the position of superintendent of freight transportation of the Pennsylvania Railroad to that of special agent in the general manager's department. Mr. Patterson was educated at the University of Pennsylvania and entered the engineering department of the Northern Pacific Railroad in 1870. Three years later he became connected with the Pennsylvania as assistant engineer. He engaged in private business from 1878 until his return to railroad work in 1882 as division superintendent of the Buffalo, New York & Philadelphia Railroad. He returned to the Pennsylvania in 1885, where his work in the transportation department brought him promotion to his new position.

WILLIAM H. CUSHMAN, hydraulic engineer, of Syracuse, N. Y., has become chief engineer of the Hydraulic Construction Company of Watertown, N. Y. Mr. Cushman has been engaged in engineering work since 1886, when he began as helper on a hydrographic survey of Duxbury Harbor, Mass. He steadily worked his way up and in 1892 supervised the construction of a gravity waterworks systems for Lancaster, N. H. Later he built a 3,000,000-gal. reservoir for that city. He was also district superintendent in the street cleaning department of New York City from 1895 to 1896, during which time he prepared a report which led to the construction of the Barren Island reduction plant. Mr. Cushman has been actively engaged in hydraulic engineering work and included in his achievements are such works as a $5,000,000 canal and power plant at Massena, N. Y., and the design and construction of a $1,300,000 dam and power house at Morgan Falls, Ga. He also has been connected with the New York State Barge Canal as resident engineer at Oswego, and was chief engineer for the Juniata Hydro-Electric Company.

DAVID R. SHEARER, consulting engineer, of Knoxville, Tenn., is making preliminary investigations for the development of a 600-hp. hydroelectric plant for the Whiting Lumber Company, at Boone, N. C.

HOWARD R. PERRIN has been transferred from the Aberthaw Construction Company's work at New Haven, Conn., to a big construction job undertaken by that concern at Buffalo, N. Y. Mr. Perrin's title will be efficiency engineer.

J. ELLINGSTON has been promoted from the position of city engineer to that of city manager of Sherman, Tex.

H. G. SHIRLEY, chief engineer, Maryland State Road Commission, ARTHUR H. BLANCHARD, consulting engineer, of New York City, and G. W. TILLSON, consulting engineer, Brooklyn, recently submitted a report on the administration, construction and maintenance of highways under the jurisdiction of the Levy Court of New Castle county, Del.

CHARLES H. HUGHES, naval architect and engineer, of New York City, has removed his office to 27 William Street.

H. K. MORGANS has resigned from his position as designing engineer for the state engineer of New Mexico, to become superintendent of construction for F. P. Davey, builder and contractor, of Detroit.

E. H. WELLES, formerly with the New York highway department, has become a member of the firm of Sherman, Welsh & Welles, general contractors, of Lakeville, Conn.

H. S. BELL has been promoted to the position of chief engineer of the new plant of the Vacuum Oil Company, at Paulsboro, N. J.

CHARLES S. GRACE has resigned from his position as junior resident engineer for the California highway commission to become connected with the Los Angeles Flood Control District as junior engineer. The plan to be prepared is said to involve an expenditure of $3,600,000.

JAMES H. VAN WAGENEN, for several years in charge of field parties engaged on the survey of the boundary line between the United States and Canada, has been appointed engineer for the International Boundary Commissions, in charge of the direction of all field and office work of the United States section of the commissions. Beginning May 15, work will be conducted in Maine, New Hampshire and Minnesota. It is estimated that the cost of this year's surveys will be about $110,000. Mr. Van Wagenen was graduated from the University of Missouri in 1908. Previous to his engagement with the boundary commissions he was with the U. S. Geological Survey on topographic surveys in North Dakota, and later was an assistant engineer with the Illinois Highway Commission.

J. R. WILBANKS has been appointed chief engineer for the Ferrocarril Samana y Santiago, with headquarters at Sanchez, Santo Domingo.

C. C. CUNNINGHAM, of the Chicago, Rock Island & Pacific Railway, has been appointed roadmaster, with headquarters at Liberal, Kan.

J. W. LEE, JR., publicity agent of the Pennsylvania Railroad at Philadelphia, has resigned, effective May 15, to become associated in business with Ivy L. Lee. George B. Harley, assistant in his office, will succeed him.

J. ALLEN WARREN, engineer with the public road office at Washington, D. C., recently visited Sacramento, Cal., to advise in a consulting capacity with the Sacramento county highway commission relative to the report of roads proposed to be constructed under a bond issue.

ROBERT GOODWIN, city engineer of Hayward, Cal., since 1878, tendered his resignation to the city trustees April 20. His successor has not as yet been named.

JACOB S. LANGTHORN, formerly division engineer for the board of water supply of New York City, was appointed deputy water commissioner of the Borough of Brooklyn, April 28. Mr. Langthorn has been in the employ of the city for several years, and was in charge of a section of the Ashokan dam. He was also associated with the engineering department of the Brooklyn, Queens County & Suburban Railroad.

J. M. ESTEP, formerly employed in the department of public works of Cleveland, has resigned to engage in the practice of consulting engineering. He has opened offices in the Marshall Building in that city. Mr. Estep was connected with the city engineering department from 1889 until his recent resignation, at which time he was assistant chief engineer. He was graduated from Rensselaer Polytechnic Institute in 1889. In 1894 he went to South America to investigate the possibilities of a proposed electric railway and water power development. Mr. Estep had charge of the expenditure of nearly $1,000,000 a year for sewer work for Cleveland at the time of his resignation.

R. A. BURNS, civil engineer and surveyor, recently opened an office at 825 Ninth Avenue, Lewiston, Idaho. Mr. Burns has had wide experience in the Northwest in railroad, irrigation and wagon road work. Previous to coming to Lewiston, he was chief engineer for the Great Northern Railway Company's coal mines, near Great Falls, Mont.

ALLAN PURVIS, formerly superintendent of the Ontario division of the Canadian Pacific Railway, with headquarters at London, has just been appointed general superintendent of the Eastern division, with headquarters at Montreal. Mr. Purvis was previously general manager of the Vancouver Electric Lines, with headquarters at Vancouver, B. C. He goes to Montreal to take the place of A. E. Stevens, who has been transferred to Moosejaw.

THOMAS COLLINS, formerly superintendent of the Canadian Pacific Railway Terminals at Toronto, has been transferred to London, on the Ontario division.

FRANK BONEY was elected street commissioner of Punxsutawney, Pa., at a special meeting of the borough council April 24.

FRANK H. ZOUCK, assistant chairman of the Maryland roads commission, has been appointed chairman of that commission, effective May 1.

E. V. RINEHART, engineer in charge of the construction and maintenance division of the water department of Baltimore, Md., has resigned.

E. A. FRETZ, who has been structural designer for the engineering department of Houston, Tex., for the past two years, has resigned to become engineer for Horton & Horton, general contractors, of that city.

## Obituary Notes

J. W. EDDY, who was active in the construction of the Angel's Flight Inclined Railway, in Los Angeles, died at Eagle Rock, Cal., recently.

THOMAS J. KEANE, superintendent of asphaltic construction in the Pennsylvania highway department and assistant in that department's testing laboratory, died at Harrisburg, Pa., April 25. He had been connected with the department since July, 1912.

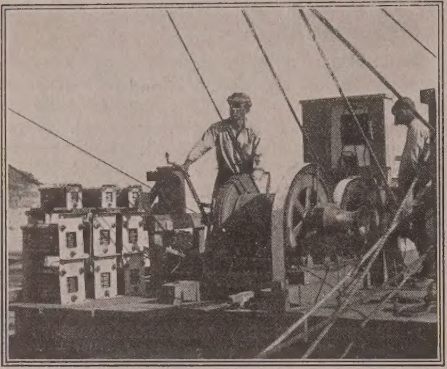
FRANK E. SKAGERLIND, an inspector in the engineering department of the city of Seattle, was instantly killed under the wheels of a Seattle, Renton & Southern street car, April 24. He had been in the employ of the engineering department since January, 1912, and was 55 years old.

COLIN MCLEAN, a well-known contractor of Baltimore, died at his home in that city on April 29, at the age of 72. He was a native of Nova Scotia and head of the McLean Contracting Company.

COL. JOHN WATERS, contractor and builder, who is said to have been instrumental in securing electric power for Baltimore, Md., died April 26 at his home in that city, at the age of 75.

## Electric Hoist Run Continuously Drives Piles with Drop Hammer

The electric hoist shown in the accompanying photograph has been used to drive piles with a drop hammer with satisfactory results, according to Arthur Looff, of Santa Monica, Cal. Mr. Looff had to drive a large number of piles for an amusement pier in a residential section where smoke and noise were highly objectionable. An electric hoist equipped with a 30-hp. Westinghouse three-phase motor, using current at 440 volts, was therefore tried. At first the rope speed was too slow, but with the substitution of new gearing it was possible to lift the hammer at a speed of 200 ft. per minute. A drop of 40 ft. was used.



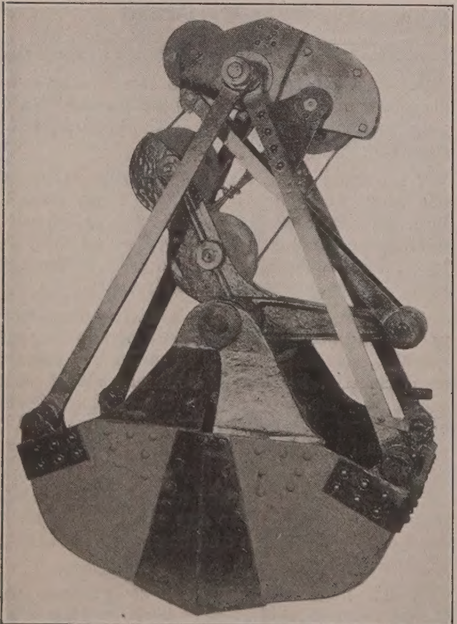
ELECTRIC HOIST ON PILE DRIVER

While the driver is in operation the motor is kept running constantly, the friction being thrown in and out to raise or release the hammer. Running the motor without load is declared to use only a trifling amount of current.

## New Bucket Is Said to Be Very Rapid Digger

A new clamshell bucket placed on the market by the Ruddock Bucket Company, of Cleveland, Ohio, is said to be a remarkably good digger due to the auxiliary arm which causes both carbon steel lips to travel at the same speed, resulting in cutting by both edges of the bucket.

The steel sheaves are of extra large diameter and bronze bushed, the pins are hammered steel and the scoops are said to be constructed to obtain rigidity. Every casting in the Ruddock is guaranteed against defects in workmanship and material for one year.

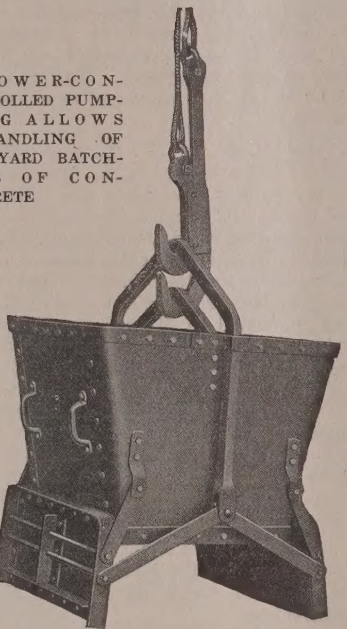


BOTH LIPS OF THIS BUCKET CUT AT THE SAME SPEED

The officers and directors of the recently incorporated Ruddock Bucket Company are: President, Wm. Ruddock; vice-president, C. E. Forsyth and E. F. Simon, Christ Koblitzer and William Olenburg.

## New Concrete Bucket Is Dumped by Hoist Runner

The principle of the double-line under-water concrete bucket has been applied to the new concrete bucket being manufactured by the Union Iron Works to put the dumping operation in direct control of the hoisting engineer. The operation of this type of bucket will be familiar to many contractors who have placed concrete under water, but the advantages of using the same bucket for open-air work are just being appreciated. Among those claimed for this bucket are much quicker dumping, the elimination of the men usually necessary on top of the form to turn and dump the bucket, and the possibility of handling concrete in 4-yd. batches and controlling the dumping, to prevent sudden strain on the forms, as readily as this can be done by hand with a ½-yd. bucket. The type of bucket adapts itself to simple mechanical design. It has no springs, catches or locks, and there are no castings used in its construction. The bucket, on account of its controlled dump feature, may be used to load dirt into wagons without the use of dumping boards. It may be rigged by using a counterweight drum for the trip line, or by tripping the bucket with a line handled by a man on the bull wheel of the derrick.



POWER-CONTROLLED PUMPING ALLOWS HANDLING OF 4-YARD BATCHES OF CONCRETE

This bucket, manufactured under the name "Unionlock," is furnished in ½, ¾, 1, 1½, 2, 3 and 4 cu. yd. sizes.

## Business Notes

**The Platt Iron Works** of Dayton, Ohio, has removed its Chicago office to the Monadnock Block.

**Rensselaer Valve Company** of Troy, N. Y., has removed its New York office to 50 Church Street.

**The Foundation Company** of Pittsburgh has removed its district branch from Wheeling to Pittsburgh.

**MacArthur Concrete Pile & Foundation Company** of New York City has removed its offices to 120 Broadway.

**The Universal Concrete Products Company** of Chicago has removed its offices to the Continental & Commercial Bank Building.

**The Independent Pneumatic Tool Company's** Atlanta (Ga.) branch was moved recently to the Jefferson County Bank Building, Birmingham, Ala.

**R. T. Stull**, ceramic engineer of the Dunn Wire-Cut Lug Brick Company of Conneaut, Ohio, was elected an honorary member of the Paving Brick Institute at the recent meeting at Portsmouth, Ohio.

**A. L. Feenaughty**, who recently resigned from his position as sales manager for the Whalen Form Company of Syracuse, N. Y., is located in Denver, Col., where he is recuperating from an operation. Mr. Feenaughty is at present selling the Edwards road graders and drags.

**The George Oldham & Son Company** of Philadelphia recently purchased a complete equipment for a new power installation. In addition, the upper floor of this company's present building is being utilized and a new equipment installed. This will greatly increase the capacity of the plant.

**The Indiana Paving Brick & Block Company** of Brazil, Ind., is the latest addition to the family of licensees of the Dunn Wire-Cut Lug Brick Company. This company has not purchased the Brazil company's plant, as was stated last week; it has merely granted them a license to make Dunn wire-cut lug brick.

## Trade Publications

**Pittsburgh-Des Moines Steel Company**, Pittsburgh, Pa., booklet, 16 pages, illustrated. Brief discussion on railway service tanks setting forth advantages of standardization, uniformity of design and permanence of construction.

**National Tube Company**, Pittsburgh, Pa., "National" Bulletin 26, 11 x 8½ in., 52 pages, illustrated. Presents advantages of autogenous welding of pipe and describes methods employed. Contains several engineering tables and a cross index.

**The Goulds Manufacturing Company**, Seneca Falls, N. Y., bulletin 120, 10 x 7¾ in., 20 pages, illustrated. First of this company's bulletins on their multi-stage centrifugal pumps, describing various sizes and adaptations of each. Also contains several cross-sections, and charts and diagrams.

**Raymond Brothers Impact Pulverizer Company**, Chicago, catalog 12, 64 pages, illustrated. Describes grinding, pulverizing and air separating machinery for any material to be reduced to powdered form. Contains drawings of model installations and partial list of materials handled by the Raymond system. Indexed.

**Stark Rolling Mill Company**, Canton, Ohio. Booklet 5½ x 8½ in., 98 pages, illustrated. Compiled in two sections, the first of which contains a treatise on the civilization of Ferris sheet metal, and the second, descriptions, reports and tables on comparative service tests of Toncan metal and a few typical installations. The treatise is an interestingly written brief history of iron and its fabrication, and the problem of corrosion.

**Deming Company**, Salem, Ohio, catalog 25, 6½ x 9½ in.; 358 pages, cloth bound. Illustrated descriptions of Deming hand and power pumps. The entire book, from arrangement of the pages, well selected illustrations and fine quality of paper, to the substantial cover, is worthy of commendation and shows an effort on the part of the manufacturer to present his products so that the customer will have little trouble in selecting the equipment he needs. In the back of the book are convenient technical tables, a good index and several protographs of Deming installations.